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ABSTRACT

Seventy-two deaf Ss (10- to 19-years-old) were tested, employing the Test of Syntactic Ability (TSA), the language sub-tests of the Stanford Achievement Test (SAT), and analyses of written language samples, in a study of the influence of early language and communication environment on their later syntactic language ability. Ss were divided into four groups: the Manual English (ME) Group whose parents were deaf, had a good command of English, and used manual communication in the form of Manual English; the Average Manual (AM) Group whose parents were deaf, had language showing gross deviations from Standard English, and used manual communication with the Ss from infancy; the Intensive Oral (IO) Group who had been enrolled in a formal Oral educational program and whose parents had received formal training in using oral methods exclusively and intensively with their children; and the Average Oral (AO) Group who had been enrolled in a formal Oral educational program and whose parents had received no formal training in oral methodology. Results showed significant superiority of the ME group over the two Oral groups on five of the six test structures of the TSA; and significant superiority of the ME group over the other three groups on all four sub-tests of the SAT. (Author/LS)

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THE INFLUENCE OF EARLY LANGUAGE AND COMMUNICATION ENVIRONMENTS ON THE DEVELOPMENT OF LANGUAGE IN DEAF CHILDREN

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CHAPTER I

PROBLEM AND OBJECTIVES

Operational Definitions

For the purpose of clarifying certain terms and abbreviations which will be used in this study, the following definitions will apply (more definitions specific to the descriptions of the sample groups and subjects (Ss) will be found beginning on page 15). The reader is cautioned that the operational definitions given herein may not be the same as those used by other researchers in the field. However, since it is essential to clarity of understanding that the reader be able to readily distinguish between the general and the specific forms of communications to which frequent reference will be made, the following terms were selected as the most appropriate.

Manual Communication (MC): This broad, generic term is used herein to mean the language of signs and fingerspelling -- the manual method of communication used in one form or another by a majority of American deaf persons. It includes signs, fingerspelling, and structured pantomime, and the term is intended to encompass the whole continuum of stylistic, grammatical, and idiosyncratic variations in the language of signs as used by the total population of deaf people in the country, from grammatically structured Manual English through unstructured or "idiomatic" American Sign Language.

Manual English (ME): In this form of MC signs and fingerspelling are used to approximate Standard English syntax. The signed and fingerspelled words of the message generally bear a one-to-one relationship with the same message when delivered verbally, and are usually accompanied by silent mouthing of the words of the message. ME may incorporate some of the recently developed "new" signs which represent some of the more functional morphemes of the English language (Wampler, 1971), but ME normally requires far more fingerspelling than do other forms of MC.

American Sign Language (ASL): This term will be used for all forms of MC other than ME. It includes the "idiomatic" language of signs, the form of MC commonly used by the large number of deaf persons who have inadequate English syntactic skills.[1]

Fingerspelling: Sometimes referred to as dactylology, fingerspelling is the representation of the 26 letters of the alphabet by 26 specific configurations and movements of the hand. Except in the Rochester Method (fingerspelling accompanied by speech but no other form of MC), fingerspelling is seldom used alone as a communicative method, but is used in combination with signs, with the amount of fingerspelling generally being dependent upon the syntactic competence of the communicators.

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[1] Some have chosen to label ASL "Ameslan", and consider it to be a language in its own right (Fant, 1971; and Stokoe, 1960); while others consider it an attempt to emulate or symbolize American English through manual means. The selection of ASL as the term to define any form of Manual Communication except Manual English was to avoid the confusion which usually results from attempts to coin new terms, and to bypass the present controversy over the legitimacy of sign language as a language per se.

Total Communication Method (TC): A methodological approach to educating deaf children in which several communications methods are used. It incorporates signs, fingerspelling, speech, speechreading, and auditory amplification with no one communication method being favored to the exclusion of the others. TC has been called, at various times, the "Simultaneous Method", the "Combined Method", and even (erroneously) the "Manual Method." There is some controversy as to whether the TC method should employ only ME, or whether it should permit the use of ASL, and it is hoped that the present investigation will provide some answers. It should be noted that the definitions used herein make a distinction between TC and Manual Methods, with the former referring specifically to methodology, and the latter being a broad term referring to any type of communication in which signs or fingerspelling are used with or without accompanying speech.

Manual Method (or Manual Group): Any method of communication in which signs and/or fingerspelling are used. (Manual is the term which will also be used in reference to and S or group of Ss with whom manual methods of communicating were used in the pre-school years.)

Oral Method (or Oral Group): The methodological approach to teaching deaf children which relies on speech, speechreading, use of residual hearing, and writing as the exclusive method of communication. In its purest form, no recourse to MC is permitted. (Oral is the term which will also be used to refer to any S or group of Ss with whom Oral methods of communication were used in the pre-school years.)

The Primary Problem

Profound deafness in a very young child has a severe impact on the child's ability to develop language. The impact is particularly severe if the onset of the hearing impairment occurred prior to the age of 24 months. Many studies have shown that profound, prelingual deafness results in language deficiencies which are extremely difficult to overcome despite intensive training in educational programs designed specifically for deaf children (Babbini and Quigley, 1970; Gentile, 1969; Cooper and Rosenstein, 1966; Boatner, 1965; Hester, 1963; Wrightstone, Aranow and Moskowitz, 1963; and others). The studies indicated that the average deaf student leaves school at the end of his academic career with an overall achievement level equivalent to that of a fourth or fifth grade non-deaf student; and a reading achievement level which may be two or three grades lower.

From what is known about the development of language skills in the normal child, there appears to be an optimum period for language learning which, if missed, may severely retard the development of the ability to use language fluently. The critical years, or the language-formative years, appear to be those between birth and age five, when the most rapid development of verbal language takes place (Mindel and Vernon, 1971; McNeill, 1966; Furth, 1966, 1964). It has been estimated that the normal child enters school with a speaking vocabulary of some 2,500 words and a recognition vocabulary of two to twenty times as large (Smith, 1941; and Smith, 1926; as described in Hilgard, 1962).

It is the verbal language acquired in the language-formative preschool years that forms the foundation of syntactic language ability upon which all later language and learning is built in the normal child, and anything that interfers with the development of this foundation cannot help but interfere with all later learning. Unfortunately, verbal language is not available to the prelingual, profoundly deaf child. The development of language in any form must await his being provided with some means of *communicating* with those around him -- and this often does not take place until he enters a formal training program for deaf children. An observed exception to this are children born to parents who are themselves deaf, and who use MC between themselves and with their children. Although there are noteworthy exceptions, the deaf child born to parents with normal hearing (hearing parents) may not be given a means of communicating until he is three, four, or even five years of age. Unless he lives in an area having one of the relatively few infant-preschool training programs for deaf children and their parents, his language development and education can commence only when he reaches the admission age of the nearest elementary education program for deaf children. Vital years are thereby irretrievably lost, for which the child pays in educational retardation resulting for inadequate language skills.

The Methods Controversy. The problem is complicated by a centuries-old controversy between two differing philosophies among educators of deaf children. One philosophy states that the deaf child should be taught to speak and read lips, and receive his education solely through employment of these skills (Oral Method), with no recourse to MC methods permitted. The other states just as firmly that any and all communication methods, Oral and Manual, should be employed in educating the child (TC method).

Proponents of the Oral Method claim that MC is largely responsible for the language deficiencies of deaf persons, citing as evidence the supposed similarity in grammatical deviations from English in the language of deaf children and adults, and the grammatical structure of ASL as used by the "average" (i.e. language-deficient) deaf adult. In addition, it is claimed, a deaf child given an "easy" method of communication such as MC will not be motivated to learn the more difficult oral skills of speech and speechreading -- and will therefore become a misfit in a world composed of people who use oral communication, not manual communication.

TC advocates, on the other hand, point out that oral skills are extremely difficult for the deaf child to acquire, and, unless the child succeeds in mastering these skills -- particularly speechreading -- his education suffers a further delay in addition to the one often occasioned by the lack of educational intervention during the first three to five years of life. In addition, if, as frequently happens, he never quite masters the oral skills required for an education by Oral methods, his educational potential is unrealized and he becomes an "oral failure" (Mindel and Vernon, 1971). Proponents of the TC method also point out that MC is usually acquired with ease by deaf children since it has the advantage of being a less complex language learning task (both expressively and receptively) for a child deprived of normal hearing and speech. Not only is it a visual communication method which is perceptively available at a far earlier age than is language-based speech, but it is far easier to master as an expressive means of communication than speech would be.

Several recent research studies have attempted to shed some light on the relative effectiveness of the Oral and Manual methods of communication by examining the educational achievement and social adjustment of deaf children raised by deaf parents who used MC with their children as compared with deaf children raised by hearing parents who used Oral communication methods (Schlesinger and Meado, 1971; Vernon and Koh, 1970; Meado, 1968; Stuckless and Birch, 1966; and Quigley and Frisina, 1961). In addition, Quigley (1969) compared two groups of pre-school deaf children in a five-year longitudinal study of the effects of fingerspelling (Rochester Method) on educational achievement, language, and communication, with one group receiving fingerspelled instruction in addition to oral instruction, and the other group receiving only oral instruction. All of the reports indicated significant differences in favor of the groups receiving exposure to some type of MC in early childhood.

All of the studies were challenged on various grounds. The differences found, while statistically significant, were pointed out to be small ones, amounting from one-half to one grade level between the groups (Meadow, 1968 found differences of two grade levels), and the achievement levels attained were still far below those of non-deaf children of the same ages. In some cases, it was also claimed that the samples tested were not truly equivalent, for no attempts had been made to select as comparison groups those orally-trained deaf children who had been provided with early and intensive exposure to langauge solely through oral communication -- the equivalent to the early and intensive exposure the children of deaf parents could be presumed to have had. Since the Manual groups had been exposed to MC since infancy, it was possible that the amount of exposure, rather than the method of communication, could account for the differences found. Had the amount of exposure been equated between the groups, the critics concluded, the differences found might well have been in the other direction. Also, of critical importance and relevance to the possible alternative explanations of the difference is the psychological impact of bearing a handicapped child which presumably is adjusted to much earlier and more readily by deaf parents than by hearing parents. Corson (1973) found that deaf parents tend to accept their child's deafness far more readily than do hearing parents, and show a more positive attitude toward their children.

Obscured in the furor, however, was the one clear fact that emerged from all of the studies. Early exposure to communication and language resulted in significant increases in later achievement of deaf children -- a finding with which no one quarreled. Focus of the disagreement centered around whether or not it was the method of communication employed which accounted for the differences, or if it was simply the amount of exposure.

The Method of Communication Used in Early Childhood. The evidence collected to date suggests that the claims of the TC advocates have some merit. It would seem reasonable to expect that a readily visible method of communication such as MC would facilitate the task of exposing a deaf child to language, and would permit this exposure to take place at an earlier age than would be possible if the child must spend several years learning the less visible method of reading lips. It would also appear that the child raised via MC methods could possibly receive ancillary benefits in that he could be exposed to daily MC in his environment as he first observes, then imitates, and finally participates in the conversations going on around him -- such as takes place in the case where the parents, and sometimes siblings, use MC. The exposure to language, therefore, would more closely approximate the auditory bombardment of language stimuli the non-deaf child is exposed to even before he is able to participate in any of the conversations going on around him than would exposure only to the less visible Oral communication.

Parental Language Competence as an Influence. Lavatelli (1971) and Valletutti (1971) hold that lower socioeconomic status has a depressing influence upon language development. Socioeconomic status is composed of three critical variables: (1) family income; (2) occupational status; and (3) education. The latter is of most direct concern, for low socioeconomic status generally goes hand in hand with minimal education, which is likely to be the source of the language problem. Low income families with minimal education often converse through a polyglot mixture of partly grammatical English and a specialized non-standard dialect that can cause cognitive confusion in the child growing up in the environment. In addition, the impoverished environment may restrict the development of any genetic potential by limiting the stimuli input or block their utilization by the child raised in lower-class families (Gottesman, 1970). The concomitant assumption would follow that the level or type of language stimuli would influence the developing syntactic language ability of the child -- provided there was no impedance to communication between the child and the parent-models who provide the majority of the language stimuli in early childhood.

No impedance exists between deaf parents and their deaf child if the parent introduces MC as soon as the child is discovered to be deaf. Therefore, the language competence of the deaf parent would be more likely to be an influence on the deaf child's developing syntactic ability than it would be in the case of a deaf child with whom his hearing parents can communicate only laboriously or not at all. The communication difficulty would severely restrict the language input, thus preventing parental language competence from influencing the child's developing syntactic ability regardless of how high the parents' language level may be. It would seem reasonable, therefore, that language-deficient deaf parents would provide poor language models for deaf children despite the ease of communication between parent and child; yet research seems to show that deaf children of deaf parents in general enjoy a statistical advantage in language development -- small but significant -- over deaf children of hearing parents. A question investigated in the present study was just how much of the reported statistical advantage was actually due to the method of communication used, and how much was perhaps due to the possible inclusion of a number of high scoring deaf children who had the added advantage of having language-competent deaf parents as models.

As was explained earlier, Manual English, or ME, is the form of MC which language-competent deaf persons normally use. It is a close approximation syntactically to Standard English, for the structure of Standard English determines the structure and ordering of the signed *and fingerspelled communications. Its use requires a good command of* English, and it is normally used by adventitiously deaf adults who lost their hearing after they had acquired verbal langauge. ME is rarely used among first-or second-generation congenitally deaf persons, for the genetic factors which combined to produce the child's deafness usually produced the parents' deafness as well — so the same impediments to the development of language existed for the parents as existed for the child. As would be expected, there are few language-competent users of ME among such parents, but there are some — usually second- or third-generation deaf persons who had deaf parents, grandparents, and often great-grandparents.

Some support for the theory that language competence of deaf parents influences the development of syntactic language ability in deaf children was obtained by Moores (in process) who is conducting a longitudinal case study of the process of communication development between MC-using deaf mothers and their deaf children. Moores videotaped the MC-conducted conversations between two deaf mothers and their deaf children at regular intervals, and then studied the tapes in an effort to analyze the growth of communication in such a way as to identify the "universals" (if any exist) of language common to all children in the language acquisition process; to investigate whether a primary language in the visual-motor mode alters any significant aspects of the development and use of language systems; to study the effects of a sign language system on the development of oral and speech skills; and to investigate the use of ASL as a pedagogical tool with deaf children of hearing parents. Moores reported that the mothers of his two Ss used different forms of MC, with one mother using ME, and the other using ASL (called Ameslan by Moores). Although slightly younger, the child of the ME-using mother was noted to be advancing faster in language acquisition than the other in that, at age 2 1/2, he was putting two and three words together in combinations approximating in some ways the pivot grammars noted in hearing children (McNeill, 1966). The other child's word-combinations remained, at the time of the report, at a more primitive level.

A similar study is being conducted by Bellugi-Klima (1971), and verbal progress reports indicate her findings will be similar to those of Moores. Both Moores and Bellugi-Klima's studies would seem to indicate that MC, when used in the grammatically correct form of ME, offers promise as a method of communication hearing parents could learn and use with their children.

Purpose of the Study

It was the intent of the present study to extend the previous studies by exerting sufficient controls on environmental variables to better delineate the factors in early environment which are felt to influence langauge development in deaf children. In order to examine the effects of the method of communication on later syntactic ability, and to expand on the work of Moores and Bellugi-Klima, the study investigated on a wider scale and across more age levels the influence of language-competent deaf, MC-using parents on the development of syntactic ability in their deaf children.

The study differs from that of Moores and Bellugi-Klima in that, where the two investigators are utilizing the longitudinal case-study approach with one or two Ss at a time, the present study examined existing syntactic language abilities of a sample of deaf children of various ages, with Ss selected according to the language competence of their parents, and the type of early language and communication environment their parents provided. It was hoped that, by applying linguistic and psycholinguistic techniques to the analysis of the language of the Ss in the study, much information would be obtained in a relatively short period of time about the dynamics of language development in deaf children, and the influence of the parent-models and the method of communication used in this development.

Objectives of the Study

The primary objective of the study was an investigation of the effects of the method of communication used with deaf children in the language-formative years of birth to age five on later language ability, by controlling the variable of language environment so that it would be possible to observe the interaction between the level of language used by the parent-models and the method of communication employed as well as the intensity and thoroughness of the exposure to language through oral means.

Specific Operational Definitions: For the purpose of clarity in outlining the hypotheses of the study and in the procedures section, the following operational definitions will apply:

1. Prelingual, profound deafness: This is defined as hearing impairment occurring prior to the age of 24 months, in which the impairment in the better ear without amplification is in excess of 90 dB (ANSI, 1969) in the frequency range of 500 to 2000 Hz.
2. Normal Deaf Ss: Hearing impaired Ss who have no educationally significant handicaps other than deafness, except for minor, corrected visual defects.
3. Syntactic Language Ability: The ability, as measured by the TSA, to recognize as correct a correctly structured sentence; and to recognize as incorrect an incorrectly structured sentence.
4. Manual English: Parents of Ss are language-competent deaf persons who used ME with Ss since infancy (ME).
5. Average Manual: Parents of Ss are deaf ASL (Ameslan) users who used this form of communication with Ss from infancy (AM).
6. Intensive Oral: Parents are language-competent hearing persons who provided Ss with early and intensive oral training in communication and language, and used exclusively oral methods of communicating with Ss during the first five years (IO).

7. Average Oral: Parents are language-competent hearing persons who provided no special training for *S*s during preschool years, but who used exclusively oral methods of communication with *S*s during the first five years (AO).

Hypotheses of the Study

The basic assumption tested in the study was that the level of language competence attained by parent-models interacted with the method of communication used in infancy and early childhood to influence the development of language ability in the prelingually, profoundly deaf child. With the amount of exposure to communication and language held constant, it was expected that differences in parental language competence would be reflected in corresponding differences in language ability in the children of those parents.

Specific hypotheses tested with respect to expected intergroup differences were as follows:

I. With respect to syntactic language ability as measured by the Test of Syntactic Ability, the following will be found:
   - (a) The ME group will be found superior to the other three groups (ME > AM, IO, AO);
   - (b) The AM group will be found superior to the IO and to the AO groups (AM > IO, AM > AO);
   - (c) The IO group will be found superior to the AO group (IO > AO).

II. With respect to language achievement as measured by the Language, Paragraph Meaning, Word Meaning, and Spelling sub-tests of the Stanford Achievement Test, the following will be found:

(a) The ME group will be found superior to the other three groups (ME > AM, IO, AO);

(b) The AM group will be found superior to the IO and AO groups (AM > IO, AM > AO);

(c) The IO group will be found superior to the AO group (IO > AO).

III. With respect to written language as measured by Type-Token Ratio, Grammatical Correctness Ratio, Mean Composition length, Number of Different Words Used, Number of Errors Per Composition, and Spelling, the following will be found:

(a) The ME group will be found superior to the other three groups (ME > AM, IO, AO);

(b) The AM group will be found superior to the IO and AO groups (AM > IO, AM > AO);

(c) The IO group will be found superior to the AO group (IO > AO).

IV. With respect to all test measures, the Manual groups (ME and AM) will be found superior to the Oral groups (IO and AO). To summarize the above, the following will apply: ME > AM > IO > AO, and (ME + AM) > (IO + AO).

CHAPTER II

METHOD

The Study Design

As can be seen from Table 1, the study design included four study groups. The four study groups were selected from three age categories: CA 10.0 through 12.11; 13.0 through 15.11; and 16.0 through 18.11.

Table 1

The Study Design (N = 72)

	Manual Groups		Oral Groups		
Chronological Age	Manual English	Average Manual	Intensive Oral	Average Oral	Total
10.0 - 12.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
13.0 - 15.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
16.0 - 18.11	3 m, 3 f	3 m, 3 f	3 m, 3 f	3 m, 3 f	12 m, 12 f
Total	9 m, 9 f (n = 18)	9 m, 9 f (n = 18)	9 m, 9 f (n = 18)	9 m, 9 f (n = 18)	36 m, 36 f

The Instruments

A questionnaire sent to the target population parents was used to help select the Ss of the study, and three measuring instruments were employed to compare the four study groups: (1) the Test of Syntactic

Ability (TSA); (2) the reading and language sub-tests of the Stanford Achievement Tests; and (3) a set of four sequential stimulus pcitures to elicit written language samples.

The Questionnaire: The questionnaire was a 21-item survey-type questionnaire designed to be answered by the parent with primary responsibility for the prospective Ss' care and training during the early childhood years. The purpose of the questionnaire was primarily that of screening the target population for suitable candidates for inclusion as Ss in the study of identifying the type of early language and communication environment the child was likely to have been brought up in.

Information obtained from the questionnaire included the following:

1. Approximate age at which S was first ascertained to be deaf, and how the parents found this out.
2. Parent's initial reactions and subsequent actions in locating help in training their child in communication and language; and the method of communication eventually decided upon and employed in the home.
3. The arguments which convinced them to decide in favor of the communication method eventually employed; and current feelings about the decision when viewed in retrospect.
4. Amount and type of training parent received in communicating with or training S; whether one or both parents received this training; and S's age when said training was first implemented in the home.

5. Consistency and intensity of home exposure to language and communication S received: (1) prior to enrollment in any formal training program for deaf children; (2) at the preschool level; and (3) at the elementary (kindergarten) level.
6. Age of S when first formal training commenced; and type and level of the educational program(s) in which the child was enrolled (i.e. infant-preschool; preschool; kindergarten; private tutoring; etc.), and length of time spent in each.
7. Parents' opinion of how successful home and school training appeared to be in terms of S's ability to communicate expressively and receptively with: family members, friend, teachers, and strangers.
8. Current method of communication being used with S; and reasons for any change from method used during S's early childhood.
9. Language competency of the primary parent as determined by evaluation of written answers to open-ended questions included for the purpose of eliciting written language samples, specially from deaf parents, without making the fact known to the respondents.

The questionnaire also elicited information on the parents' education occupation and income, which information was subsequently used to compute the socioeconomic status (SES) of the study groups.

Test of Syntactic Ability (TSA); Rationale for Selection: The instrument for measuring syntactic language ability of the Ss was the TSA, which was developed by Quigley and Power (1971) in the third year of a five-year research program in which the transformational-generative grammar techniques described by Chomsky (1965, 1957; and others) were utilized in an effort to specify the kinds of rules which deaf children develop and use to produce their sentences. Transformational-generative grammar techniques are felt to offer more information about the language development in deaf children than is the case with traditional grammar analyses. As stated in the rationale for the TSA:

> "It would seem that if we could accurately describe the rules that deaf children use to produce their 'deviant' sentence, we would be in a better position to develop curricula and remedial teaching methods."

To carry this statement one step further, one might add that, if we could accurately describe the types of environments in which these rules develop, it would seem that we would also be in a position to identify the type of early language environment -- or infant-preschool "curricula" most conducive to the development of rules which produce non-deviant sentences and maximize the chances of the deaf child's not needing remedial teaching methods when he begins his formal education.

The TSA was selected as the measuring instrument for a number of reasons. First, it was felt that the TSA is a valid measuring instrument for testing syntactic competence in deaf children because:

1. It was designed and developed specifically for use with deaf children after two years of intensive linguistic analyses of language samples obtained from deaf children -- instead of being an adaptation of a test designed for and standardized on children with normal hearing.
2. It has been field-tested on normal children, and some of the resultant data are therefore available for comparison purposes.
3. It has been field-tested with a sample of deaf Ss which was:
    a. Large enough to constitute a normative population;
    b. Representative of the total population of deaf students between the ages of 10.0 and 18.11 in that appropriate stratified random sampling techniques were used to select both the target population and the individual Ss.
    c. Tested under standardized testing conditions in that test administrators were given training; testing took place at the same general time of the year for all Ss; and the test situation was identical insofar as grouping of Ss, number of testing sessions, length of test sessions, and instructions given the Ss by the trained test administrators.

Second, it was felt that, since the process of language development was more appropriately a topic of interest to the present study than language achievement per se would be, the TSA was an appropriate tool to use when studying the dynamics of language and environment.

Third, data from the Quigley test program were available and easily accesible, and these data could serve the purpose of a normative population with which the study _S_s performance could later be compared should a post hoc study become feasible. In addition, the Quigley _S_s provided a pool from which some of the study _S_s could be selected at random by use of a computer.

Fourth, since the Quigley data were collected in the Fall of 1971, and, in common with the present study, were collected in an ad hoc study across the same age ranges, the time element was not likely to confound the results to any significant degree.

Fifth, 16 persons were trained in administration of the TSA during the Quigley program, and it was anticipated that some of these trained persons could be utilized to administer tests to _S_s in their areas who were not previously tested in the Quigley study, thus making in unnecessary for one of the writers to travel to those areas to do the testing.

Finally, the TSA is simple to administer, and scoring procedures had been developed which facilitated the task of analyzing the data.

Description of the TSA: The TSA is a battery of 22 tests designed to elicit information about deaf children's understanding of the functions of six major aspects of English syntax: Verb Usage, Relativization, Conjunction, Negation, Question Formation, and Pronominalization.

Within the test battery are found two sub-categories of item-formats: Multiple Choice format, and Right-Wrong-Rewrite. The Multiple Choice format includes several sub-divisions in format. Some are the familiar "choose the one correct response (from a number of possibles)" type; others provide for "yes" or "no" answers about whether or not a sentence shares certain characteristics with the example sentence, or describes the event depicted in the example sentence.

The Right-Wrong-Rewrite format requires the S to decide whether or not a sentence is correct; and if he decides it is incorrect, to rewrite the sentence in a form he considers acceptable. Below is a typical item (from the Negatives sub-test):

Not the man see the boy (example sentence)

Check ☑ one box.

The sentence is:

RIGHT: ☐

WRONG: ☐ Change the sentence to make it RIGHT.

Write the right sentence here.________________________________

____

For all the sub-tests, the "Wrong" sentences were either taken from written compositions of deaf children collected in an earlier study or,where they did not appear in the written samples, were constructed by systematically varying relevant aspects of the sentence (e.g. the auxiliary verb). In most cases for the Right-Wrong-Rewrite format, two examples of each right and wrong structure are given. In some cases four or six sentences might be given to balance a large number of possible wrong constructions. Only on one of the two occasions on which he is presented with a given structure (either correct or incorrect) is the child required to rewrite it if he thinks it is wrong. This helps (a) to lower the temptation to check "Right" if the child is not quite sure, and (b) to reduce the time necessary to complete the test. By analysis of responses to "right" and "wrong" sentences and of the rewritten "wrong" sentence, it is possible to chart the development of acceptance of both correct and incorrect rules in the language of deaf children.

With the multiple-choice sub-tests, two items are given for each structure. Distractors for these items were chosen with a view to the logic of the types of errors made by deaf children. The order of presentation of all items and distractors was, wherever possible, randomized to minimize the likelihood of development of response sets. (For a more detailed description of the TSA, the reader is referred to "Rationale For the Construction of the Test of Syntactic Ability" (Experimental Edition), Institute for Research on Exceptional Children, University of Illinois, Champaign Illinois, 61820.) The scoring of the TSA will be discussed in the section dealing with Collection and Scoring of the Data.

Stanford Achievement Test (SAT): With three exceptions, all of the study Ss were routinely administered the Stanford Achievement test batteries appropriate to their ages and grade levels in April or May, 1972 by the schools in which they were enrolled. The three exceptions were administered the test by one of the writers since the school in which all three were enrolled did not plan to administer the test to any of its students. Only the reading and language-related sub-test scores (Paragraph Meaning, Word Meaning, Language, and Spelling) were used in comparing the groups.

The Stimulus Pictures: The stimulus pictures used to elicit written language samples from the Ss were a sequence of four cartoons shown on a single sheet of paper depicting a family's preparations for a trip to a picnic as well as activities during the picnic. The Ss were asked to write a story about the pictures.

The Subjects

General Criteria for Selection: Initial selection for the Ss for the study target population was based on the criteria established by Quigley (1969) for the purpose of selecting Ss for his large scale testing program in Fall, 1971, in which the TSA was used. These general criteria for deaf Ss were:

1. Age: CA 10.0 to 18.11.
2. Age at onset of deafness: 24 months or younger.
3. Hearing threshold level: Greater than 90 dB (ANSI, 1969) in the better ear without amplification, averaged in the frequency range of 500 to 2000 Hz.
4. Physical and intellectual capacity: Minimum performance IQ of 90 on the WISC, WAIS, or the equivalent on other, comparable measures of IQ; and no educationally significant handicaps other than deafness except for minor disabilities such as corrected visual defects.

Selection of Quigley's Subjects: In brief, Quigley's procedures utilized stratified random sampling techniques to select 16 representative day and residential programs for deaf students from the total number of such schools and programs having enrollments of 100 or more pupils. The selection was based on the day and residential school populations of deaf students in the areas delineated by the U. S. Bureau of the Census (American Annals of the Deaf, 1970), and the required number of Ss was distributed across those nine areas. The number of Ss required from each of the selected schools was then determined by the ratio of day program enrollments to residential program enrollments in the region. To exemplify, if 70% of the total regional student population was enrolled in residential programs, and 30% in day programs, then 70% of the Ss would be selected from the representative residential school, and 30% would be drawn from the representative day program. The predetermined number of Ss from each randomly selected representative school, equally divided between male and female Ss at nine age levels, was then selected at random from the students in the school who met the criteria outlined in the preceding section.

Selection of Study Subjects: Since the present study was not an experimental one in which the experimenter (E) could manipulate the Ss' early language and communication environment, it was of ciritical importance that the environmental variables be controlled by establishing specific criteria for each of the four study groups, and then selecting as Ss only those whose early childhood backgrounds met the criteria. Also, in view of the highly select characteristics required for inclusion in the two "elite" contrast groups, the ME and the IO groups, and the comparatively small number of the required type of Ss in the general population, customary random sampling procedures could not be employed. As will be explained in more detail, the parents' responses to certain items in the questionnaire (mailed to all target population parents) were utilized to assign each S to one or another of the four study groups, contingent on the S's background meeting the specific criteria established for each group.

Before outlining the criteria specific to each of the groups, a brief explanation of the rationale for the selection of the criteria is in order. First, the assumption is made that language-competent deaf adults will normally use a form of MC that follows correct English word order -- ME in other words. The second assumption is that, given two language-competent deaf parents, ME will be the form of MC used within the home, both in daily conversations among adult family members and their deaf friends -- and with any deaf children the family may contain. It would therefore seem logical that a deaf child of ME-using deaf parents, having been exposed to ME from infancy, would not only be fluent in MC by the time he entered school, but would also have begun to generate English grammatical rules through his long exposure to ME during his early childhood.

From one of the writer's observation of language-competent deaf parents among his acquaintances, and from personal interviews he subsequently conducted with one or both parents of eight of the participating ME group Ss, ME was the form of MC used with and around the children, and the standards of performance were such that the child was frequently required to communicate in grammatically correct English, with deviations immediately and automatically reflected back correctly by the parent, and hopefully then corrected by the child in the course of the conversation. Other than this, however, the training in language normally consisted of "doing what comes naturally", the type of "training" given by any parent raising and socializing a child; the only difference being that communication took place manually rather than orally.

On the other hand, conscientious parents of the type selected for the IO group were those who exerted every effort toward obtaining the best Oral training possible for their child and worked closely with school personnel in implementing such training in the home. They learned how to use the oral method themselves, and used it consistently, intensively, and continually in all their dealings with their child. They also structured learning situations in the home to the extent where the home became, in effect, an extension of the school. Most of the IO parents enrolled immediately in an infant-preschool training program for deaf children and their parents if one was available in their area, or sent away for the correspondence course offered by the John Tracy Clinic in Los Angeles, which offers an infant-preschool training program for parents. These Ss were the children who had been enrolled at the earliest possible age in a formal preschool training program with the parents actively cooperating with the school in seeing that such training is reinforced and augumented in the home.

By the same token, it was felt that while a child having ASL-using deaf parents would enjoy a length-of-exposure communication advantage over one having parents who used no form of MC with him during his early childhood, the language deficiencies of ASL-using deaf parents would tend to make them poor language models of English when compared with the average hearing parents. The AM group Ss consequently were chosen from the group whose parents' written responses showed grammatical deviations from Standard English typical of average deaf adults.

The AO group Ss were chosen from those whose parents reported little or no preschool training, and, consequently, no implementation of training in the home during the child's first four years. These were parents who did little more than follow the advice, "Talk, talk to your child" until local, minimum school enrollment age.

Specific Criteria, All Ss with Deaf Parents:

1. Both parents were themselves hearing impaired.
2. Both parents used MC as the primary method of communication in the home, and use it with S from the time S was ascertained to be deaf.

Specific Criteria, All Ss with Hearing Parents:

1. Both parents had normal hearing.
2. Both parents employed only oral methods of communication in the home, and used them exclusively until the child was at least six years of age.

Criteria for Placement in Each Study Group: As can be seen from Table 2, there were certain additional criteria imposed on the selection of Ss for each study group. To be included in the ME group, a S's deaf parents' responses to the open-ended questions in the questionnaire had to be written in acceptable English grammar. If deviations from Standard English were noted in the responses, the S was automatically placed in the AM group on the assumption that the primary parent used ASL. By the same token, to be included in the IO group, the primary parent of a S had to have reported (1) early enrollment of the child in an educational program; (2) parent received training in oral methods; and (3) intensive and detailed accounts of what was done to implement school training at home. To insure a buffer zone between the IO Ss and the AO Ss, no S was permitted to be included in the AO group whose primary parent reported enrolling the child in a training program before age four; home implementation of school training, if any, was begun after age four, and, in any case, was limited to attempts to talk to the child a lot rather than to structure specific learning situations at home; and, finally, neither parent received any kind of training in oral methodology during the child's first five years.

Location of the Target Population: After consulting the Office of Demographic Studies (ODS) at Gallaudet College, a total of 29 educational programs were contacted with a request for names and addresses of prospective Ss who met the study criteria, along with a request for permission for the ODS to release pertinent demographic data on those Ss. Names and addresses were obtained from schools which, according to the ODS, showed five or more students whose parents were deaf, and who met previously outlined criteria for Ss. From the ODS as well as from other independent sources, a target population of 470 names were obtained; 64 of which were eliminated for various reasons. A total of 406 questionnaires were then mailed out, 266 going to deaf parents of prospective Ss, and 140 going to hearing parents. Responses were subsequently received from 246 parents. Of the returned questionnaires, 32 were subsequently rejected for a number of reasons (too young, too

TABLE 2: Specific Criteria for Selection for Each Study Group (Based on Parents' Responses to Questionnaire Items)

Variable	GROUP ME	 IO	 AM	
Parents hearing ability	Both Impaired	Both Normal	Both Impaired	Bo
Method of comm'n used in Ss first 6 yrs.	ME	Oral	ASL	Or
Age child first enrolled in educ. program	(no criteria)	prior to age 24 mo.	(no criteria)	af 4
Parents' attempts at training in the home	(not applicable)	continuous and intensive	(not applicable)	Fo
Parents' language competence [a]	acceptable (no deviations)	(no criteria)	deficient (typical deviations)	(
One or both parents received training in using Oral method with S	No	Yes	No	N

[a] Hearing parents language was automatically screened for acceptable grammar however and whe gross deviations were noted (as happened in two cases where the hearing parent-respondent was obviously semi-literate), the student was eliminated from further consideration as a subject.

ABLE 2: Specific Criteria for Selection for Each Study Group
(Based on Parents' Responses to Questionnaire Items)

	GROUP			
	ME	IO	AM	AO
ity	Both Impaired	Both Normal	Both Impaired	Both Normal
d in	ME	Oral	ASL	Oral
lled	(no criteria)	prior to age 24 mo.	(no criteria)	after age 4 yrs.
	(not applicable)	continuous and intensive	(not applicable)	Few or none
	acceptable (no deviations)	(no criteria)	deficient (typical deviations)	(no criteria)
th S	No	Yes	No	No

guage was automatically screened for acceptable grammar however and where
re noted (as happened in two cases where the hearing parent-respondent
literate), the student was eliminated from further consideration as

old, one parent hearing and the other deaf, too much residual hearing, incomplete information, etc.), leaving a population of 214 from which the study sample was drawn.

Some restrictions were placed on selection by the need to insure representation at each age level, and distribution of the sexes at each level. However, this created a problem in only two cases. One S whose parent's language competence was only marginally acceptable had to be included to complete one of the ME age groups; and another, while his parent's language competence was acceptable, was subsequently reported (by school authorities) to have emotional problems. No substitute of the same age and sex being available to replace him, his scores were used to fill a cell in the AM group.

Procedure for Selection of the Subjects: As each questionnaire was received, it was immediately placed in one of two general categories and was assigned a code number according to whether the respondent was deaf or hearing. Working independently, two specialists in education of deaf students then divided all questionnaires received from deaf parents into two categories; (1) those in which the written responses to open-ended questions were in acceptable English, and those in which the written responses showed gross deviations from Standard English. Where there was concensus of opinion between the two specialists, the student named in the questionnaire was then assigned to the ME (acceptable English) or the AM (deviant English) S pools from which final selection was made. Differences of opinion (which occurred in only two cases) were resolved by eliminating the prospective S from the study.

Questionnaires received from hearing parents were also categorized by the same two specialists, again working independently, according to:

1. Age of child at entry into a formal education program (if prior to age two, IO group; if subsequent to age four, AO group).
2. Whether or not one or both parents received training in using oral methods of communication (if yes, IO group; if no, AO group).
3. Amount of home implementation of training reported (if detailed descriptions, IO group; if non or "we just talked to him a lot" type of responses, AO group).

It must be noted, however, that inclusion in the IO group was contingent on the responses indicating that the *S*'s early environment met *all three* of the above listed criteria; and inclusion in the AO group was contingent on the responses indicating that the *S*'s early environment met *none* of the criteria for inclusion in the IO group.

Final Selection of Each Group: After preliminary screening and assignment, prospective *Ss* were divided into age groups by sex. As was anticipated, the ME group lacked sufficient *Ss* to fill all age and sex cells (three *Ss* of each sex in each age grouping were required by the study design), and had only one surplus *S* at one age level. As it happened, the AM group had a surplus *S* of the age and sex needed to fill the ME cell and lacked one *S* of the same age and sex as the surplus ME *S*. The *Ss* were therefore reassigned as was discussed on the preceding page.

As can be gathered from the foregoing, final selection of the ME group consisted of using every *S* of the right age and sex that could be located, plus one borderline *S* that could have been an AM *S*. With the exception of a few cells which had surplus *S*s, the same was true of final selection of the AM group. Where there was a surplus in a cell in the AM group, final selection was made by choosing the *S*s whose parental language was the most deviant. As a final check, coded language samples from the questionnaires received from parents of the selected *S*s for the ME and AM groups were submitted to a six-man evaluation team composed of three doctoral students in linguistics, one staff member in linguistics, and two specialists in education of deaf students. Working independently, the team members separated the coded samples into two piles, one consisting of samples which the expert judged to be in acceptable English and the other consisting of samples judged to be in poor English. The results of the sorting were analyzed, and inter-rater reliability coefficients obtained showed 90.7% concensus of opinion, with disagreement found only on the two *S*s mentioned earlier as having been reassinged out of their group.

Final selection of the IO *S*s was made by selecting for the IO group three males and three females at each level whose parents reported them as having been enrolled in formal training programs for deaf children at the earliest ages and having been enrolled in such programs continuously from that time onward; whose parents had received training in using oral methods; and about whom the parent had reported the most intensive and detailed descriptions of what had been done to implement school training at home.

Since the information obtained from the questionnaire also showed that many of the Oral group parents had later changed their minds about Oral methods, and had since begun to use sign language with their children, selection priority was given to those Ss whose parents had not changed from the original method of communication. Only when a cell could not be filled by an "uncontaminated" Ss (one who was still being taught by oral methods exclusively) was a S selected who was currently being exposed to MC, and even then, priority was given to those Ss who were the oldest when the change was made.

The AO Ss were selected at random from those prospective Ss whose parents reported not having been enrolled in any infant-parent preschool program; whose parents had not enrolled their children in any educational program for deaf children until after age four; little or no home implementation of school training was reported; and, insofar as was possible, the Ss were still being taught by oral methods and oral methods of communication were still being used in the home. Again, when insufficient numbers of "uncontaminated Ss forced the selection of Ss whose parents had changed from oral to manual methods of communication, priority was given to those Ss who were the oldest when the changeover was made.

The above selection priorities resulted in an IO group of whom ten were still "uncontaminated" by any form of MC; five had been exposed to gestures in addition to Oral methods at a mean age of seven years; and three had been exposed to sign language and/or fingerspelling at the mean age of 9.6 years. The AO group was composed of six "uncontaminated" Ss; eight who had been exposed to gestures in addition to Oral methods; and four who had been exposed to sign language and/or fingerspelling from a mean age of 10.5 years.

Procedures

The procedures followed after selection of the Ss was completed, generally followed those outlined in the TSA test manual. The test situation was kept as nearly identical to the Quigley test situations as was possible but some adaptions in terms of length and number of test sessions was necessary. The Quigley testing took place in the type of situation recommended in the TSA manual, with no more than five Ss tested in a group in the 10-12 age groups; six in the 13-15 age groups; and 10 in the 16-18 age groups. But, whereas the Quigley testing sessions were one hour in length, and were spread out over several days, this was not possible in the present study, for the Quigley test administrators were school personnel employed on a regular basis in the participating schools and were therefore available for however long the testing took. The testing sessions in the present study were lengthened to two hours with a break after the first hour in order to keep the number of days spent in each area to a maximum of four days.

It is recognized that this increased the possibility that the fatigue factor may have confounded performance near the end of a lengthy testing session, but it was believed that block-randomizing of the order of subtest administration, and the breaks provided counteracted this effect for most Ss. In addition, the test situation was kept informal, which tended to make the Ss regard the testing as a welcome break from routine school tasks. Since none of the tests in the battery was timed, and Ss were permitted to complete each one at their own individual paces, fatigue-inducing time-pressure was not a factor.

The SAT, as was mentioned earlier, was routinely administered to all but three Ss in the study. One of the authors administered the test to those three, following standard administration procedures for the SAT.

Written language samples for some of the Ss were already available as a result of the Quigley testing program. For those Ss not already tested, the Ss were given the cartoon stimulus pictures and asked to write a story about them, with this part of the testing usually taking place after the TSA had been administered and a short break taken. In some cases, however, the language samples were obtained on the following day (some Ss took longer to finish the TSA than did others). In all cases, the Ss were encouraged to take as much time as they liked, and to use their own words.

Collection and Treatment of the Data: Except where one of the authors conducted the testing himself, the TSA data and the written language samples were collected by trained test administrators at the schools. The SAT scores were also obtained from the participating schools (except for the aforementioned three Ss who were administered the SAT by one of the authors).

Scoring, TSA: Simple per cent correct of the recognition portion of the TSA was used in the study. Due to lack of time and resources, no attempt was made to analyze the production portion of the tasks (the Rewrite portion of the Right-Wrong-Rewrite test items).

Scoring, SAT: Scoring of the SAT followed that outlined in the SAT test manual.

Scoring, written language samples: Grammatical Correctness Ratio was computed as the percentage of the number of grammatically correct words to the first 50 words of the composition. Type Token Ratio was computed as the ratio of the number of different words used to the total number of words in the first 50 words of the composition. Composition Length was a direct count of the number of words in each composition. Number of errors per composition was a direct count of the total number of errors in the first 50 words of each composition exclusive of spelling errors. Percentile scores were obtained using the variable equations for age fourteen. (Stuckless and Marks, 1966).

Scoring, SES: SES scores were computed from questionnaire information on education, occupation and family income, using Duncan's Socioeconomic Index (1961) to determine occupational ranking. For each family, the following formula was used:

$$\frac{\text{Father's education} - \bar{X}\text{ of total sample fathers' education}}{\text{SD of total sample fathers' education}}$$

$$+\frac{\text{Mother's education} - \bar{X}\text{ of total sample mothers' education}}{\text{SD of total sample mothers' education}}$$

$$+\frac{\text{Father's occupation} - \bar{X}\text{ of total sample fathers' occupation}}{\text{SD of total sample fathers' occupation}}$$

$$+\frac{\text{Mother's occupation} - \bar{X}\text{ of total sample mothers' occupation}}{\text{SD of total sample mothers' occupation}}$$

$$+\frac{\text{Family income} - \bar{X}\text{ of total sample family income}}{\text{SD of total sample family income}}$$

$$\frac{\text{Sum of above}}{\text{Total No. of factors*}}$$

*5 if both parents work;
4 if mother does not work.

The data were scored, coded, and punched on IBM cards by graduate assistants who were kept in ignorance of group composition as well as the main purpose of the study. After punching, the data were then analyzed by means of the IBM 360/75 computer in the Digital Computer Laboratory at the University of Illinois.

Statistical Analyses: Part of the data obtained from the questionnaire compared for differences among the groups in SES and PIQ. The rest of the data were simply tabulated and are presented in table form in the Questionnaire Results section. The TSA, SAT, and written language data were subjected to multivariate analyses of variance (MANOVAs) with three covariates (SES, PIQ and age); to three-way analyses of variance (ANOVAs); and, to compare the combined manual groups with the combined oral groups, t-tests of pooled means and pooled variances were used with the formula (Guenther, 1964):

$$t_{n_1} + t_{n_2} - 2 = \frac{\bar{x}_1 - \bar{x}_2 - (u_1 - u_2)}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

The groups were also tested for homogenity and independence using the chi-square test, and for equality of variance using Cochran's test (to check for possible differences in variance which would have precluded using the method of Scheffe' for contrasts).

The groups were compared on each of the 22 dependent variables of the TSA as well as for the combined variables in each of the six major syntactic structures, on the four SAT language-related subtests, and on the five variables selected for analysis from the written language samples. Studied were differences among the groups, differences in growth patterns across the age levels, and differences between the sexes. Significant differences, when found, were subjected to contrast comparisons by both the method of Scheffé and that of Tukey in order to identify specific differences between the groups on the age, sex and task dimensions. Discriminant function analyses from the MANOVA were examined for differences which existed between the groups as a function of the structures tested.

CHAPTER III

QUESTIONNAIRE DATA

Geographical Distribution of the Subjects

The Ss were drawn from eight of the nine regions of the U. S. Bureau of the Census (American Annals of the Deaf, 1971). Table 3 shows the distribution of the Ss by region. As can be seen from the table, the largest percentage (22.2%) were drawn from schools in the South Atlantic states (Maryland through Florida), and the smallest (3.4%) from the West South Central states. The East South Central states were not represented in the sample. The other Ss were more or less equally distributed among the remaining six geographical regions.

Types of Programs Contacted

A total of 29 educational programs for deaf students were contacted, all of which had enrollments in excess of 100 pupils (Table 4). Among these contacted were four Public Day Class programs, two Public Day School programs, 16 Public Residential Schools, one Private Day School, four Private Residential Schools, and two Private Parochial Residential Schools.

Method of Communication Used in Schools

Ten of the schools contacted employed the Oral method of communication exclusively in both primary and upper grades. Of the remaining 19 programs,

Table 3

Geographical Distribution of Schools Contacted, and Number of Subjects Selected, by Age and Sex

	Total Subjects		Age Group							
			10.0 - 12.11		13.0 - 15.11		16.0 - 18.11			
Region[a]	No.	% of Sample	M No.	F No.	M No.	F No.	M No.	F No.	Male No.	Fe
I New England	10	13.9	1	4	0	2	1	2	2	
II Mid-Atlantic	10	13.9	2	1	1	0	4	2	7	
III E. No. Central	11	15.3	3	2	1	4	0	1	4	
IV W. No. Central	9	12.5	2	2	3	1	1	0	6	
V So. Atlantic	16	22.2	1	2	4	4	1	4	6	
VII W. So. Central	1	1.4	0	0	0	0	1	0	1	
VIII Mountain	5	6.9	1	1	1	0	1	1	3	
IX Pacific	10	13.9	2	0	2	1	3	2	7	
Total	72	100	12	12	12	12	12	12	36	

[a] Region VI (E. So. Central) not represented in sample.

Table 3

Distribution of Schools Contacted, and Number of Subjects Selected, by Age and Sex

tal		Age Group						
jects	10.0 - 12.11		13.0 - 15.11		16.0 - 18.11			
% of Sample	M No.	F No.	M No.	F No.	M No.	F No.	Male No.	Female No.
13.9	1	4	0	2	1	2	2	8
13.9	2	1	1	0	4	2	7	3
15.3	3	2	1	4	0	1	4	7
12.5	2	2	3	1	1	0	6	3
22.2	1	2	4	4	1	4	6	10
1.4	0	0	0	0	1	0	1	0
6.9	1	1	1	0	1	1	3	2
13.9	2	0	2	1	3	2	7	3
100	12	12	12	12	12	12	36	36

) not represented in sample.

Table 4

Number of Schools Contacted; Number and Per Cent Responding; Number of Deaf and Hearing Parents Contacted; and Number and Per Cent of Subjects Selected: By Enrollment of Schools

	Schools Contacted			Parents Contacted			
School Enrollment	No. Contacted	No. Cooperating	Per Cent	Total Contacted	Deaf Parents	Hearing Parents	No. of Subjects Selected
100 - 199	4	2[a]	50.0	12	0	12	4
200 - 299	9	6[a,b]	66.7	102	66	36	21
300 - 399	5	5	100.0	64	42	22	12
Over 400	7	7	100.0	228	158	70	35
Total	25	20	80.0	406	266	140	72

[a] No response was received from one school.

[b] Includes one school which cooperated to the extent of granting permission for ODS to releas names and data, but withheld permission to test Ss pending further consideration. (The sc was eventually dropped for other reasons -- see text.)

Table 4

chools Contacted; Number and Per Cent Responding; Number of Deaf and
arents Contacted; and Number and Per Cent of Subjects Selected: By
Enrollment of Schools

Schools Contacted			Parents Contacted				
o. acted	No. Cooperating	Per Cent	Total Contacted	Deaf Parents	Hearing Parents	No. of Subjects Selected	Per Cent of Possibles
4	2[a]	50.0	12	0	12	4	33.3
9	6[a,b]	66.7	102	66	36	21	20.6
5	5	100.0	64	42	22	12	18.8
7	7	100.0	228	158	70	35	15.4
5	20	80.0	406	266	140	72	17.7

ed from one school.

ich cooperated to the extent of granting permission for ODS to release
thheld permission to test *Ss* pending further consideration. (The school
for other reasons -- see text.)

all except four employed Oral methods in the primary grades but permitted some form of MC to be employed in the upper grades (combined schools). However, at the time of the study (1972-73), one of the exclusively Oral schools and 12 of the Partly Manual schools were either in the process of changing to the TC approach or were planning to do so in the following academic year. Of the four exceptions noted earlier, three had either completed a change to TC prior to 1972, or were employing the Rochester Method (now called Visible English, which employs fingerspelling in addition to oral methods, but does not permit the use of signs); and the other one had always employed MC throughout the school.

Cooperating Schools

Among the 29 programs contacted, no response at all was received from two exclusively oral programs, and an additional four exclusively oral programs declined to participate. Partial cooperation was promised by a fifth exclusively oral program in that the program agreed to the release of data on potential Ss by the ODS, but withheld permission to conduct testing pending further examination of the study objectives. The latter program was subsequently dropped from consideration as a possible source of Ss when cooperation was obtained from a comparable program elsewhere, and it was discovered that the program did not have Ss who met the required criteria of age, sex, and hearing loss needed for the study.

The remaining three exclusively oral and the 19 manual or combined programs all agreed to cooperate fully in releasing data and permitting testing if suitable Ss were located among the pupils and subsquently selected for the study.

A total of 406 questionnaires were mailed to parents of the prospective Ss whose names and demographic data had been obtained from the cooperating schools and the ODS (see Table 4). Ss were eventually selected from 14 of the schools by the process described earlier under Selection of the Subjects. Table 5 shows the number of Ss selected and tested by program enrollment.

Table 5

Subjects Selected for Each Group, By School Enrollment
(N = 72)

Enrollment of Schools	Manual English Group	Average Manual Group	Intensive Oral Group	Average Oral Group	Total
100-199	0	0	4	0	4
200 - 299	3	7	6	5	21
300-399	6	4	0	2	12
400 and up	9	7	8	11	35
Total	18	18	18	18	72

Note: The TSA was administered and written language samples obtained by Brasel for 21 of the Ss; by the Quigley study for 41 of the Ss; and by school personnel for 10 of the Ss. All but three of the Ss (who were tested by Brasel) were administered the SAT by school personnel.

Descriptive Data

Age and Performance IQ: Tables 6 and 7 give descriptive data on the Ss and their parents. As can be seen from Table 6, the mean age of each group of Ss was identical (14.8 years), and for three out of the four groups, no significant difference was found in PIQ. The only difference found in PIQ was found to exist between the ME group and the AO group ($p > .05$). It will be noted that the two manual group parents determined that their children were deaf at around six months of age, while the oral group parents did not make this confirmation until their children were a bit over one year of age. It is likely this was due to the high degree of awareness congenitally deaf persons have when they have a child that the child might be deaf, and thus they confirm any hearing impairment much sooner than hearing parents. Another finding of note was that, while deaf parents were quick to note their children's deafness, they did not enroll their children in an educational program for deaf children until the children were four to four and a half years of age (the study made no attempt to control for preschool training among the manual groups although this was controlled for the oral group).

Socioeconomic Status: There were noteworthy differences among the groups in the SES of the families. As can be seen from Tables 6 and 7, although the ME and IO group parents reported almost identical amounts of education, there were differences between the two groups in occupational status and income, with the IO group reporting higher income and higher

Table 6

Descriptive Data, Subjects and Parents, by Group
(N = 72, 36 male and 36 female subjects)

Descriptive Item	Manual English n = 18	Average Manual n = 18	Intensive Oral n = 18	Average Oral n = 18
Mean Age	14.8	14.8	14.8	14.8
PIQ[a]	121	114	119	107
Age deafness confirmed	0.58 yr.	0.39 yr.	1.19 yr.	1.23 yr.
Age began schooling[b]	55.8 mo.	50.7 mo.	23.9 mo.	50.5 mo.
SES factor of parents[c]	1.14	-2.02	2.63	-1.61

[a] Difference in PIQ was significant ($p > .05$) only between the ME and the AO groups.

[b] Differences between the two Oral groups is the result of the selection process. (No control was exerted over the two manual groups in Age began Schooling.)

[c] Intensive Oral group was significantly higher in SES than the other three groups ($p > .001$).

Table 7

Mean Socio-Economic Status (SES) of Parents of Study Subjects

Group	Average Gross Family Income	Average Income Per Wage-Earner	Years of Education		Occupational Status Index		Both Parents Work	One Parent Families
			Father	Mother	Father	Mother		
Manual English	$ 15,972.	$ 8,984.	15.2	13.8	51.9	46.1	14	0
Intensive Oral	17,569.	11,714.	15.0	14.0	61.2	53.0	9	1
Average Manual	9,306.	6,204.	9.4	10.3	22.5	15.8	9	2
Average Oral	10,000.	7,826.	11.2	11.6	52.6	32.1	5	5
Mean, All Groups	$ 13,212.	$ 8,682.	12.7	12.5	47.3	37.3		
SD	651.99		4.13	3.55	23.36	23.93		

Table 7

Mean Socio-Economic Status (SES) of Parents of Study Subjects

e Gross ily ome	Average Income Per Wage-Earner	Years of Education		Occupational Status Index		Both Parents Work	One Parent Families	Mean SES Family
		Father	Mother	Father	Mother			
972.	$ 8,984.	15.2	13.8	51.9	46.1	14	0	1.1366
569.	11,714.	15.0	14.0	61.2	53.0	9	1	2.6311
306.	6,204.	9.4	10.3	22.5	15.8	9	2	-2.0222
000.	7,826.	11.2	11.6	52.6	32.1	5	5	-1.6121
212.	$ 8,682.	12.7	12.5	47.3	37.3			
551.99		4.13	3.55	23.36	23.93			

job status despite equal amounts of education. The differences were even more marked between the IO group and the AM group, which reported the least education, the lowest family income, and the lowest occupational status. It would be well to note at this point that, although the ME group fathers reported considerably more education than did the AO fathers, the AO fathers reported occupations that were slightly higher in status than did the ME fathers. These findings support the notion that deaf people tend to be underemployed in comparison to hearing persons of similar abilities.

Of interest, also, is the mean income per wage earner, for the figures indicate that more than 40% of the family income for the ME group was contributed by working mothers, whereas only 33% of the family income of the IO group was attributable to the mothers. The fact that this figure may be depressed is supported by the data which indicated that all except four of the ME mothers worked whereas only half of the IO mothers reported they were employed.

The SES factors clearly show the following, with the IO group being significantly higher than the other three groups:

$$\text{IO} > \text{ME} \overset{>}{=} \text{AO} \overset{>}{=} \text{AM}$$

Composition of the Families: As presented in Table 8, the ME group contained 16 intact families, and two families in which one

Table 8

Family Composition: By Group

Group	No. of Intact Families	No. of Single-Parent Families	No. of Step of Adoptive Families	No. of Deaf Siblings
Manual English	16	0	2	19
Average Manual	17	0	1	23
Intensive Oral	13	2	3	1
Average Oral	12	3	3	0

natural parent had been replaced by a step parent (one father and one mother). In addition, 13 of the families reported a total of 19 deaf siblings in addition to the Ss used in the study (as a matter of fact, five sibling pairs were used in the study, three in the ME group and two in the AM group). The AM group included 17 intact families, and one family in which there was a step parent. Fourteen families reported a total of 23 deaf siblings. The large number of deaf siblings would seem to indicate that most of the Manual group Ss were exposed to a great deal of MC in their environments, for not only did their parents use MC, but their siblings also.

The IO group included one foster parent family (grandparents of the S); one family in which the S was adopted at 14 months of age; one family in which a step parent had replaced one parent; two single-parent families (both divorced mothers); and 13 intact families. Only one of the IO group reported any other deaf children.

Three single-parent (divorced mothers) families were included in the AO group, as well as two families in which there were step fathers, and one which was an adoptive family. None of the 12 intact families nor the six broken/adoptive families in the AO group reported any other deaf children.

Parent and Child Preschool Training: Although eight of the ME and 11 of the AM group respondents reported having received training in working with deaf children, interviews with the eight ME respondents elicited the information that they were referring to the training they received in becoming teachers of deaf children and some were referring to their own educational experiences (some of them were teachers at the time of the study) rather than training specifically designed to help them with their own children.[2] Since the ME respondents misunderstood the question, it is likely that the AM group respondents did so also, for in every case where the AM respondent reported such training, the name of the program given was that of the school the parent had attended, most of which did not have infant-parent or preschool programs of the type in question; and, in any event, the responses to other questions made it clear that misunderstanding had occurred. Only one ME mother reported having received parent-infant training of the nursery school type, although seven of the ME and nine of the AM Ss had been enrolled in educational programs by the time the Ss were 4.5 years of age (see Tables 9 and 10).

---

[2] Of those eight responses, the examination of the response to the occupation question itself reveals that only two have parents who are both teaching the deaf and one whose father is a teacher of the deaf. In all three cases they are upper school teachers who teach specific subjects. Two S's (siblings) mother teaches Art History at Gallaudet and one S's father is a vocational teacher. The other two respondents were referring to their own educational experience.

Tables 9, 10 and 11 show that the IO group parents sought out parent-infant and preschool training when the Ss were quite young (mean age 23.9 months), and, in most cases, sought out more than one type of program in which to enroll themselves and their children. They also

Table 9

Parents and Child Pre-School Training: By Group

	Parents received training			Child received training from (number of types)			
Group	Both Parents	Mother Only	Total Parents	4 or more	3	2	1
Manual English	0	1	1	0	0	0	7
Average Manual	0	0	0	0	0	0	9
Intensive Oral	4	14	22	8	6	4	0
Average Oral	3	2	8	0	0	0	9

TABLE 10: Preschool Training By Type, All Groups

	Correspondence Course		Parent-Infant		Preschool		Private	Other		Speech	
	Mother	Father	Mother	Father	Mother	Father	Tutor	Mother	Father	&Hear	Tota
Manual English	0	0	0	0	0	0	0	1	0	0	1
Intensive Oral	11	3	5	0	7	0	2	1	1	5	35
Average Manual	0	0	0	0	0	0	0	0	0	0	0
Average Oral	4	1	0	1	1	1	1	0	0	0	9

TABLE 10: Preschool Training By Type, All Groups

rent-Infant		Preschool		Private	Other		Speech		Mean Per
ther	Father	Mother	Father	Tutor	Mother	Father	&Hear	Total	Family
0	0	0	0	0	1	0	0	1	0.05
5	0	7	0	2	1	1	5	35	1.94
0	0	0	0	0	0	0	0	0	0.0
0	1	1	1	1	0	0	0	9	0.50

Table 11

Mean Age Subjects Began Schooling; Number of Hours per Week of Pre-School Training; and Hearing Aid Usage

	Pre-School Training			Mean Age Began Continuous Schooling in years	Hearing Aid Usage			
							Still Wearing Aid	
Group	Mean Age Began in Months	Mean Hours per week	Mean Mos. in attend. prior to Age 6		No. fitted W/aid	Mean Age when fitted	all of most of time	only when req'd
Manual English	55.8	11	18.5	4.5	14	5.1 yr	2	2
Intensive Oral	23.9	18	47.2	2.8	18	3.2 yr	8	7
Average Manual	50.7		28.0	4.3	8	4.9 yr	0	5
Average Oral	50.5	11.2	21.7	4.2	14	5.1 yr	3	7
Total					54		13	21
Mean	45.2	15.1	28.9	4.0		4.6 yr		

Table 11

ubjects Began Schooling; Number of Hours per Week of Pre-School Training; and Hearing Aid Usage

Pre-School Training			Mean Age Began Continuous Schooling in years	Hearing Aid Usage				
						Still Wearing Aid		
ean ge egan in onths	Mean Hours per week	Mean Mos. in attend. prior to Age 6		No. fitted W/aid	Mean Age when fitted	all of most of time	only when req'd	No longer wearing aid
55.8	11	18.5	4.5	14	5.1 yr	2	2	10
23.9	18	47.2	2.8	18	3.2 yr	8	7	3
50.7		28.0	4.3	8	4.9 yr	0	5	3
50.5	11.2	21.7	4.2	14	5.1 yr	3	7	3
				54		13	21	19
45.2	15.1	28.9	4.0		4.6 yr			

reported the Ss were in school an average of 18 hours per week during the preschool years, and the respondents reported intense follow-up of school training in the home. This was indicated by detailed descriptions of how the respondents applied the school training in the home, with most of them covering the backs of the questionnaire pages with comments, a few of which are given below.

Descriptions of Home Training Reported by IO Group Parents: The following is a partial list of the most commonly described techniques reported by IO parents as what they did to implement school training at home. The comments that follow were repeated in different words from the majority of the respondents in the group.

> "We worked with him for two hours every day..."
>
> "We made a scrap book of all the things we did and used it to help him to learn to read the words on our lips..."
>
> "We would make him repeat a word until he got it right before we would give him what he was trying to ask for..."
>
> "We made labels and stuck them on all the furniture..."
>
> "We purchased plastic animals, objects and used household objects and repeated the name and color of the object when holding it up, then asked for a certain object and our child would pick up the object asked for..."
>
> "All our hours were training hours whether actually sitting down working (on speech or lipreading) or going about the day's household tasks..."
>
> "Made scrapbooks with generic words..."
>
> "While at the Speech and Hearing Clinic, I watched through the one-way glass and took many notes. The teacher made assignments for us after each class — the next teacher had me bring a different technique to learn the same word — for three days."
>
> "Had a pegboard and balls and various size shoes in a basket..."

"Had fish cut out of various colored paper..."

"Had a bag of balls and a box of shoes, and as (S) took one from each, he said the word..."

"We spent an hour or so together every day. I cut out objects and he would match them together. I would have it labeled underneath the picture..."

"We were continuously repeating the names of objects as he would view them..."

"Talk, talk and more talk --- about what we were doing, household work, shopping -- and later tried to show concepts..."

"Worked daily, using Tracy Clinic advice, lots of pictures on cards, scrapbooks of unusual events, photos of our home and furnishings to identify rooms, etc. -- talked to (S) constantly..."

"A corner of our family room was set up with a blackboard, little chairs, a mirror, and all the things he used at school -- and we worked there for an hour or two every evening after dinner..."

Every one of the 18 IO respondents filled at least two pages with written comments such as those listed above, and several filled four or more pages detailing their efforts to insure that their children were being exposed to as much learning as possible through oral means. All of them reported working closely with their children's teachers so as to insure reinforcement and augumentation of school learning at home. At least half of the respondents mentioned frequent observation of their child's classroom work as well as conferences with teachers, and it is likely that most of the others did so also, even though they didn't happen to mention it in their lengthy descriptions of what they did at home with their children.

Hearing Aid Usage: Four of the ME and 10 of the AM Ss were never fitted with hearing aids. Among the Ss in those two groups who were fitted with aids (at a mean age of about 5 years), only two ME Ss were still wearing their aids when not required to do so. The others in both groups had either discontinued wearing them entirely, or wore them only when required to do so at school.

All of the IO Ss had been fitted with aids, at an average age of about two and a half years, and eight still continued to wear them when not specifically required to do so. Among the remainder, three had discarded their aids entirely, and seven wore them only in school. The AO group included 14 who had been fitted for aids, three who still chose to wear them all or most of the time, seven who wore them only in school, and three who had discontinued wearing them at all.

CHAPTER IV

RESULTS

Stanford Achievement Test

One-Way ANOVAs (for unequal n's) and Scheffé's Contrasts: Only the scores obtained on the four language-related sub-tests of the SAT were analyzed in the study. Because of the range of SAT batteries employed (from Primary I through Advanced I), it was not possible to obtain scores on the same four sub-tests for all of the Ss. Therefore, only those Ss were used for whom scores were obtained on (1) Language; (2) Paragraph Meaning; (3) Word Meaning; and (4) Spelling. The following results were obtained through use of one-way Analysis of Variance (ANOVA) for unequal n's.

SAT Language Sub-Test: Table 12 shows the means, standard deviations, and mean age of the Ss for whom scores on the Language subtest of the SAT were available. As can be seen, the ME group scores showed them to be 2.5 to 3.7 grades ahead of the other three groups. The ANOVA showed that the difference among the groups was significant at the .0001 level of confidence (Table 13). Scheffé's contrasts identified the differences as existing between the ME group and each of the other three groups, with the other three groups being found to have no significant difference among them (Table 14).

SAT Paragraph Meaning Sub-Test: As was found in the Language Subtest of the SAT, the ME group again performed better than the other three groups on the Paragraph Meaning sub-test of the SAT (Tables 15,

TABLE 12: Stanford Achievement Test Means and Standard Deviations Language Sub-Test: All Groups (N = 65)

	Manual English	Average Manual	Intensive Oral	Average Oral
Number	14	17	17	17
$\overline{X}$ Age (in yr.)	14.9	14.8	15.1	14.9
$\overline{X}$ Grade equiv.	8.05	5.56	5.64	4.35
SD	2.0527	1.8134	1.8868	1.7482

TABLE 13: Analysis of Variance Table, SAT Language Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between groups	107.829	3	35.943		
Within groups	213.255	61	3.496	10.28	$<.0001$
Total	321.084	64			

TABLE 14: Scheffé Contrasts, Confidence Intervals, SAT Language Sub-Test

ME - AM	(.55, 4.43)*	ME > AM by 2.49 grade equiv.
ME - IO	(.47, 4.35)*	ME > IO by 2.41 grade equiv.
ME - AO	(1.76, 5.64)*	ME > AO by 3.7 grade equiv.
IO - AM	(-1.77, 1.93)	IO = AM
IO - AO	(- .56, 3.14)	IO = AO
AM - AO	(- .64, 3.06)	AM = AO

Significant at<.05 or higher.

TABLE 15: Stanford Achievement Test Means and Standard Deviations
Paragraph Meaning Sub-Test: All Groups (N = 70)

	Manual English	Average Manual	Intensive Oral	Average Oral
Number	18	18	17	17
$\overline{X}$ Age (in years)	14.8	14.8	15.1	14.9
Grade equiv.	7.01	4.89	5.25	3.88
S.D.	2.3685	1.9230	2.10	1.5363

16 and 17). Although the difference among the groups was found to be significant at the .001 level of confidence, the difference between the ME group and the AM and AO groups were the only ones significant at .05 or better. The difference between the ME and IO group only approached significance ($p > .10$) even though the ME group mean was nearly two grade equivalents higher than that of the IO group. As will be explained shortly, an ANOVA using equal n's was also performed to permit using the more liberal t-method contrasts. This showed the ME group to be significantly better than the IO group ($p > .05$).

SAT Word Meaning Sub-Test: Tables 18, 19 and 20 show the results of the analyses of the scores for the groups on Word Meaning. As can be seen, only one significant difference was found among the groups, this being between the ME and the AO group. Again, however, it can be seen that the ME group was nearly one grade ahead of its nearest competitor, the AM group; 1.69 grade ahead of the IO group; and 2.27 grades ahead of the AO group. (ANOVAs for equal n's and t-method contrasts picked up significant differences in Word Meaning. This will be discussed later.)

SAT Spelling Sub-Test: Tables 21 and 22 show the results of the analyses of the groups' scores on the Spelling Sub-Test. All four groups did much better on Spelling than on the other language-related subtests, with the ME group again out-performing the other three.

Table 16

Analysis of Variance Table, SAT Paragraph Meaning Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between groups	89.50	3	29.83	7.3852	<.0001
Within groups	266.62	66	4.0396		
Total	356.12	69			

Table 17

Scheffé Contrasts, Confidence Intervals, SAT Paragraph Meaning Sub-Test

ME - AM	(.19, 4.05)*	ME > AM by 2.12 grade equiv.
ME - IO	(- .1926, 3.4985)**	ME = IO by 1.76 grade equiv.
ME - AO	(1.17, 5.09)*	ME > AO by 3.13 grade equiv.
IO - AM	(-1.60, 2.32)	IO = AM
IO - AO	(- .62, 3.36)	IO = AO
AM - AO	(- .95, 2.97)	AM = AO

* Significant at P < .05

** Significant at p < .10

TABLE 18: Stanford Achievement Test, Means and Standard Deviations, Word Meaning Sub-Test: All Groups (N = 45)

Word Meaning	Manual English	Average Manual	Intensive Oral	Average Oral
Number	11	14	9	11
$\bar{X}$ Age (in years)	13.7	14.1	13.3	13.6
$\bar{X}$ Grade equiv.	5.25	4.29	3.56	2.98
SD	1.5795	1.6915	0.8973	0.1694

TABLE 19: Analysis of Variance Table, SAT Word Meaning Sub-Test

Source of Variance	SS	df	MS	F	Prob.
Between Groups	31.2481	3	10.416	5.4278	.01
Within groups	78.68	41	1.919		
Total	109.9281	44			

Table 20

Scheffe' Contrasts, Confidence Intervals, SAT Word Meaning Sub-Test

ME - AM	(- .669, 2.589)	ME = AM	
ME - IO	(- .1293, 3.5093)	ME = IO	
ME - AO	(.528, 4.012)*	ME > AO	by 2.27 Grade equiv.
IO - AM	(- 2.454, .994)	IO = AM	
IO - AO	(- 1.2373, 2.3973)	IO = AO	
AM - AO	(- .5073, 3.1273)	AM = AO	

* Significant at .05 or higher

Table 21

Stanford Achievement Test, Means and Standard Deviations, Spelling Sub-Test: By Group

Spelling	Manual English	Average Manual	Intensive Oral	Average Oral
No.	16	14	13	12
$\overline{X}$ Age (in years)	15.0	15.8	15.9	16.3
$\overline{X}$ Grade equiv.	9.36	7.94	7.75	6.82
SD	2.7772	2.1802	2.4395	2.1912

Only one difference among the groups approached significance, however, when the ANOVAs for unequal n's was used: that between the ME and the AO group ($p > .10$). (Again, this changed when ANOVAs for equal n's and t-method contrasts were used.)

One-Way ANOVAS for Equal n's and Tukey's (t-method) Contrasts: In order to take advantage of the more liberal Tukey (t-method) contrasts, it was decided to balance the groups by either eliminating the scores of the S of the most deviant age within a cell or by filling a gap within a cell by adding a hypothetical S for whose scores the cell mean was employed. This procedure resulted in some unavoidable small changes in the means and standard deviations of the groups, but every possible effort was made to insure that each cell was balanced on the number of Ss at each age level to avoid possibly skewing the data by eliminating Ss whose scores would raise or lower the group means unduly. The following data are the results obtained in this fashion.

SAT Language Sub-Test Using Equal n's: As was found in the ANOVA using unequal n's and Scheffe´ contrasts, the ME group outscored the other three groups. The only effect that using the equal-n's/Tukey contrasts made was to increase the level of confidence from .05 to .005 (Tables 23, 24 and 25).

SAT Paragraph Meaning Sub-Test Using Equal n's: As can be seen from Tables 26, 27 and 28, deleting the scores of one S from each of the ME and the AM groups, then re-analyzing the data using Tukey

TABLE 22: Analysis of Variance Table, SAT Spelling Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between Groups	47.1285	3	15.71	2.65	$<.10$
Within Groups	301.72	51	5.92		
Total	348.849	54			

Note: Scheffé's contrasts showed the main difference between groups was between the ME and the AO group although the difference only approached significance ($p < .10$) but did not achieve it.

TABLE 23: Stanford Achievement Test Means and Standard Deviations: All Groups (N = 68), Equal n's; Language Sub-Test

	Manual English	Average Manual	Intensive Oral	Average Oral
	n = 17	n = 17	n = 17	n = 17
$\overline{X}$ Age (in mo.)	15.0	15.0	15.1	14.9
$\overline{X}$ Grade equiv.	8.03	5.56	5.64	4.35
S.D.	1.9257	1.8134	1.8868	1.7482

TABLE 24: Analysis of Variance (Equal n's), SAT Language Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between Groups	107.829	3	35.943	10.28	<.0001
Within Groups	213.255	61	3.496		
Total	321.084	64			

TABLE 25: Tukey Contrasts, Confidence Intervals, SAT Language Sub-Test

	Conf. Interval	Prob.
ME - AM	(.19, 4.59)	<.005
ME - IO	(.27, 4.67)	<.005
ME - AO	(1.46, 5.88)	<.001
IO - AM	(-2.12, 2.28)	ns
IO - AO	(- .91, 3.49)	ns
AM - AO	(- .99, 3.41)	ns

TABLE 26: Stanford Achievement Test Means and Standard Deviations, All Groups (N = 68), Equal n's; Paragraph Meaning Sub-Test

	Manual English	Average Manual	Intensive Oral	Average Oral
	n = 17	n = 17	n = 17	n = 17
$\overline{X}$ Age (in yr.)	15.0	15.0	15.1	14.9
$\overline{X}$ Grade equiv.	7.24	5.06	5.06	3.88
S. D.	2.27	1.8461	2.10	1.5363

TABLE 27: Analysis of Variance Using Equal n's, SAT Paragraph Meaning Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between Groups	98.66	3	32.887	8.70	$<.0001$
Within Groups	242.21	64	3.78		
Total	340.87	67			

contrasts resulted in significant differences ($p > .05$) being found between the ME and the IO groups as well as increasing the level of significance of the difference already found between the ME and the AM and AO groups by use of the Scheffé contrasts.

SAT Word Meaning Sub-Test Using Equal n's: In equalizing the n's in the cells on the Word Meaning sub-tests, five Ss were deleted from the AM group and two Ss were deleted from the AO and ME groups in order to match the nine Ss in the IO group for whom Word Meaning scores were obtained. Tables 29, 30 and 31 show the results of the re-analysis of the data, using Tukey contrasts. In contrast to using the unequal-n's ANOVA, the equal-n's and Tukey's contrasts detected significant differences between the ME and the IO groups, and between the AM and the AO group as well as the difference between the ME and the AO groups that was found when using the Scheffé contrasts.

SAT Spelling Sub-Test, Using Equal-n's: Again, equal-n's ANOVAs and Tukey contrasts detected significant differences that the unequal-n ANOVA and Scheffé contrasts failed to detect. The ME group was again shown to be significantly better in spelling than the other three groups although somewhat younger than the two Oral groups. Tables 32, 33 and 34 show the results of the re-analysis of the Spelling data.

Table 35 gives a composite picture of the four groups on all language sub-tests as analyzed by both types of ANOVAs. As can be seen, the ME group was significantly better than the other three groups on all dimensions when the ANOVA for equal n's was employed.

TABLE 28: Tukey Contrasts, Confidence Intervals
SAT Paragraph Meaning Sub-Test

	Conf. Interval	Prob.
ME - AM	(.23, 3.75)	$< .05$
ME - IO	(.42, 3.94)	$< .05$
ME - AO	(1.60, 5.12)	$< .001$
IO - AM	(-1.57, 1.95)	ns
IO - AO	(- .39, 3.13)	ns
AM - AO	(- .58, 2.94)	ns

TABLE 29: Stanford Achievement Test Means and Standard Deviations, All Groups (N = 36) Equal n's; Word Meaning Sub-Test

	Manual English	Average Manual	Intensive Oral	Average Oral
	n = 9	n = 9	n = 9	n = 9
$\overline{X}$ Age (in yr.)	13.7	14.0	13.8	14.0
$\overline{X}$ Grade equiv.	5.70	4.87	3.56	3.19
S.D.	1.3564	1.6552	0.8973	0.998

TABLE 30: Analysis of Variance Table, Equal n's,
SAT Word Meaning Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between Groups	36.6	3	12.2	7.649	<.0001
Within Groups	51.05	32	1.595		
Total	87.65	35			

TABLE 31: Tukey Contrasts, Confidence Intervals,
SAT Word Meaning Sub-Test

	Conf. Interval	Prob.
ME - AM	(- .78, 2.44)	ns
ME - IO	(.53, 3.75)	<.05
ME - AO	(.23, 4.79)	<.005
IO - AM	(-2.92, 0.30)	ns
IO - AO	(-1.24, 1.98)	ns
AM - AO	(.07, 3.29)	<.05

TABLE 32: Stanford Achievement Test Means and Standard Deviations All Groups (N = 48) Equal n's; Spelling Sub-Test

	Manual English	Average Manual	Intensive Oral	Average Oral
	n = 12	n = 12	n = 12	n = 12
$\overline{X}$ Age (in yr.)	15.4	15.4	15.7	16.3
$\overline{X}$ Grade equiv.	10.58	8.15	7.48	6.82
S.D.	1.7657	2.2948	2.3354	2.1912

TABLE 33: Analysis of Variance Table, Equal n's, SAT Spelling Sub-Test

Source of Variation	SS	df	MS	F	Prob.
Between Groups	97.16	3	32.39	6.95	$<.0005$
Within Groups	205.04	44	4.66		
Total	302.20	47			

TABLE 34: Tukey Contrasts, Confidence Intervals
SAT Spelling Sub-Test

	Conf. Interval	Prob.
ME - AM	(.30, 4.56)	$<.05$
ME - IO	(.62, 5.58)	$<.025$
ME - AO	(.48, 7.04)	$<.005$
IO - AM	(-2.80, 1.46)	ns
IO - AO	(-1.47, 2.79)	ns
AM - AO	(- .93, 3.33)	ns

TABLE 35: Stanford Achievement Test Means, All Language Sub-Tests, Unbalanced and Balanced Cell N's

	Unequal N's			
	ME	AM	IO	AO
Language No. Ss	14	17	17	17
Mean Age	14.9	14.8	15.1	14.9
Mean Grade	8.05	5.56	5.64	4.35
SD	2.0527	1.8134	1.8868	1.7482
Paragraph Meaning No. Ss	18	18	17	17
Mean Age	14.8	14.8	15.1	14.9
Mean Grade	7.01	4.89	5.25	3.88
SD	2.3685	1.923	2.10	1.5363
Word Meaning No. Ss	11	14	9	11
Mean Age	13.7	14.0	13.8	13.6
Mean Grade	5.25	4.29	3.56	2.98
SD	1.5795	1.6915	0.8973	0.1694
Spelling No. Ss	16	14	13	12
Mean Age	15.0	15.8	15.9	16.3
Mean Grade	9.36	7.94	7.75	6.82
SD	2.7772	2.1802	2.4396	2.1912
	Equal N's			
Language No. Ss	17	17	17	17
Mean Age	15.0	15.0	15.1	14.9
Mean Grade	8.03	5.56	5.64	4.35
SD	1.9257	1.8134	1.8868	1.7482
Paragraph Meaning No. Ss	17	17	17	17
Mean Age	15.0	15.0	15.1	14.9
Mean Grade	7.24	5.06	5.25	3.88
SD	2.227	1.8461	2.10	1.5363
Word Meaning No. Ss	9	9	9	9
Mean Age	13.7	14.0	13.8	14.0
Mean Grade	5.70	4.87	3.56	3.19
SD	1.3564	1.6552	0.8973	0.998
Spelling No. Ss	12	12	12	12
Mean Age	15.4	15.4	15.7	16.3
Mean Grade	10.58	8.15	7.48	6.82
SD	1.7667	2.2948	2.3354	2.1912

Test of Syntactic Ability

Multivariate analyses of variance (MANOVA, Jeremy Finn, State University of New York at Buffalo, adapted for the University of Illinois by James Wardrop and Thomas J. Bligh) were performed and showed highly significant differences among the groups on all 22 sub-tests of the TSA as well as on the six major syntactic structures tested, even after removing the effects of SES, PIQ, and age, singly and in combination. The results of removing the effects of SES, PIQ, and age are presented below.

F-ratio for Multivariate test of equality of mean vectors, effects of SES eliminated: 2.1901; df 18, 175.8478; $p > .0051$

F-ratio for Multivariate test of equality of mean vectors, effects of SES and PIQ eliminated: 1.8734; df 18, 173.0913; $p > .0209$

F-ratio for Multivariate test of equality of mean vectors, effects of SES, PIQ and age eliminated: 2.4001; df 18, 170.1909; $p > .0020$

Unfortunately, however, due to a previously undetected flaw in the design of the MANOVA program itself (subsequently verified by Dr. James Wardrop, who adapted the program for the University of Illinois), it proved to be impossible to make paired comparisons of the groups on the six test variables in order to identify the source of the differences found. Accordingly, the attempt to perform contrasts by use of the MANOVA program was abandoned, and balanced design, three-factor analyses of variance (BALANOVA) were substituted, using Age, Sex and Group as the three covariates.

Age and Sex: The BALANOVA showed significant differences in performance between the age groups on all test structures, with test performance improving significantly with age. Table 36 shows the mean percentage scores for male and female Ss in each age group on each of the six categories of tests. As can be seen, the females generally did better than the males, but only on the Negation sub-tests was this difference significant, and then only in the youngest age group (age 10 to 13).

Differences Among the Groups: As can be seen from Table 37, the ME group outperformed the other three groups; the AM group outperformed the IO and AO groups; the IO group outperformed the AO group; and the two Manual groups outscored the two Oral groups. The significance of the differences are shown in Table 38, which summarizes the results of Scheffé contrasts performed to pinpoint the source of the differences among the groups found by the BALANOVAs.

In analyzing the results of the six groups of tests of the TSA, it was found that the Relativization structures were apparently the most difficult for the groups to master. Next most difficult were the Verb Usage structures, followed by Pronominalization, Conjunction, Question Formation, and Negation in that order, with the latter structure apparently the easiest.

Before discussing the groups in relation to their performance on the six general structures, however, it would be well to point out to the reader that when the two groups with deaf parents were contrasted

TABLE 36: Test of Syntactic Ability, Mean Percentages, All Groups Combined, by Age Group and Sex (N = 72)

Total	Relativization	Question-Formation	Negation	Conjunction	Verb Usage	Pronominalization
Age 10.0-12.11						
Male	60.68	59.816	71.516	61.46	64.89	57.558
Female	61.42	70.025	81.96	71.675	68.31	68.175
Total	61.054	64.92	76.742	66.57	66.604	62.86
Age 13.0-15.11						
Male	71.36	79.358	89.16	76.46	78.283	76.616
Female	67.61	79.408	89.716	78.33	72.27	78.458
Total	69.847	79.383	89.442	77.39	75.279	77.537
Age 16.0-18.11						
Male	70.29	85.442	87.849	80.12	74.89	85.008
Female	76.01	92.442	94.125	89.17	80.583	90.716
Total	73.154	88.941	90.987	84.649	77.74	87.86
All Ages						
Male	67.449	74.87	82.84	72.686	72.694	73.061
Female	68.347	80.625	88.603	79.727	73.72	79.116
Total	67.898	77.786	85.724	76.207	73.208	76.08

TABLE 37: Test of Syntactic Ability Mean Percentage Scores, Ranges and Standard Deviations, by Group and Structure (N = 72)

Group	Relativization	Question-Formation	Negation	Conjunction	Verb Usage	Pronominalization
ME						
Mean %	80.87	89.8	91.9	87.5	82.2	89.9
Range %	50.8-95.2	59.2-99.3	82.9-100.0	36.3-98.8	65.8-94.7	66.7-99.3
S.D. %	11.94	11.36	4.86	15.80	8.86	9.54
IO						
Mean %	66.3	76.0	84.9	73.1	69.4	71.2
Range %	47.6-92.4	34.5-99.3	53.4-97.3	26.3-100.0	42.1-89.5	23.3-98.0
S.D. %	13.29	19.74	12.30	21.23	14.34	23.07
AM						
Mean %	66.4	81.3	86.7	76.5	74.5	78.7
Range %	47.6-90.3	52.1-94.4	47.3-97.3	37.5-96.3	50.0-90.8	40.7-96.0
S.D. %	13.56	15.31	12.41	16.79	11.35	19.07
AO						
Mean %	58.1	64.0	79.4	67.6	66.8	64.6
Range %	43.6-75.8	28.2-94.4	43.8-95.2	30.0-93.8	51.3-85.5	32.7-97.3
S.D.%	8.53	18.63	15.29	15.84	10.71	19.31
TOTAL						
Mean %	67.898	77.786	85.724	76.207	73.208	76.08
Range %	43.6-95.2	28.2-99.3	43.8-100.0	26.3-100.0	42.1-94.7	23.3-99.3
S.D. %	11.12	13.63	10.32	16.16	10.83	15.42

TABLE 38: Summary of Scheffé Contrast Results[a]

Contrast	Relativization	Question-Formation	Negation	Conjunction	Verb	Pronominalization
ME - IO	$P < .01$	$P < .05$	$P < .10$	$P < .07$	$P < .025$	$P < .01$
ME - AM	$P < .01$	ns	ns	ns	ns	ns
ME - AO	$P < .001$	$P < .0001$	$P < .005$	$P < .01$	$P < .005$	$P < .0001$
IO - AM	ns	ns	ns	ns	ns	ns
IO - AO	ns	$P < .10$	ns	ns	ns	ns
AM - AO	ns	$P < .01$	ns	ns	ns	$P < .10$
(ME + AM) - (IO + AO)	$P < .003$	$P < .001$	$P < .03$	$P < .03$	$P < .005$	$P < .002$

---

[a] No significant differences found on Cochran's test of equality of variance and Chi-square test of independence.

with the two groups having hearing parents, significant differences were found in favor of the deaf-parent groups on every one of the six general structures as well as on overall TSA performance (p > .0005). This supports previous findings which reported statistical superiority of deaf children of deaf parents over deaf children of hearing parents. It is when the groups are contrasted individually, however, that the source of this superiority becomes clear. The ME group was significantly better than the IO group on four of the six major test structures; significantly better than the AO group on all test structures; but significantly better than the AM group on only one test structure (the most difficult Relativization tests) -- whereas the AM group was significantly better than the AO group on only one test structure (Question Formation); and not significantly better than the IO group on any of the six major test structures despite their higher mean percentages.

Figures 1, 2 and 3 show the per cent scores on all six main structures by group according to age, and Figure 4 shows the means on all six test structures for all ages combined for each group.

Relativization: Table 39 shows the percentages of each group on the three sub-tests of the Relativization structures. As can be seen from the BALANOVA summary table (Table 40), there were significant differences among the groups. These differences were found to exist between the ME group and the other three groups when Scheffe

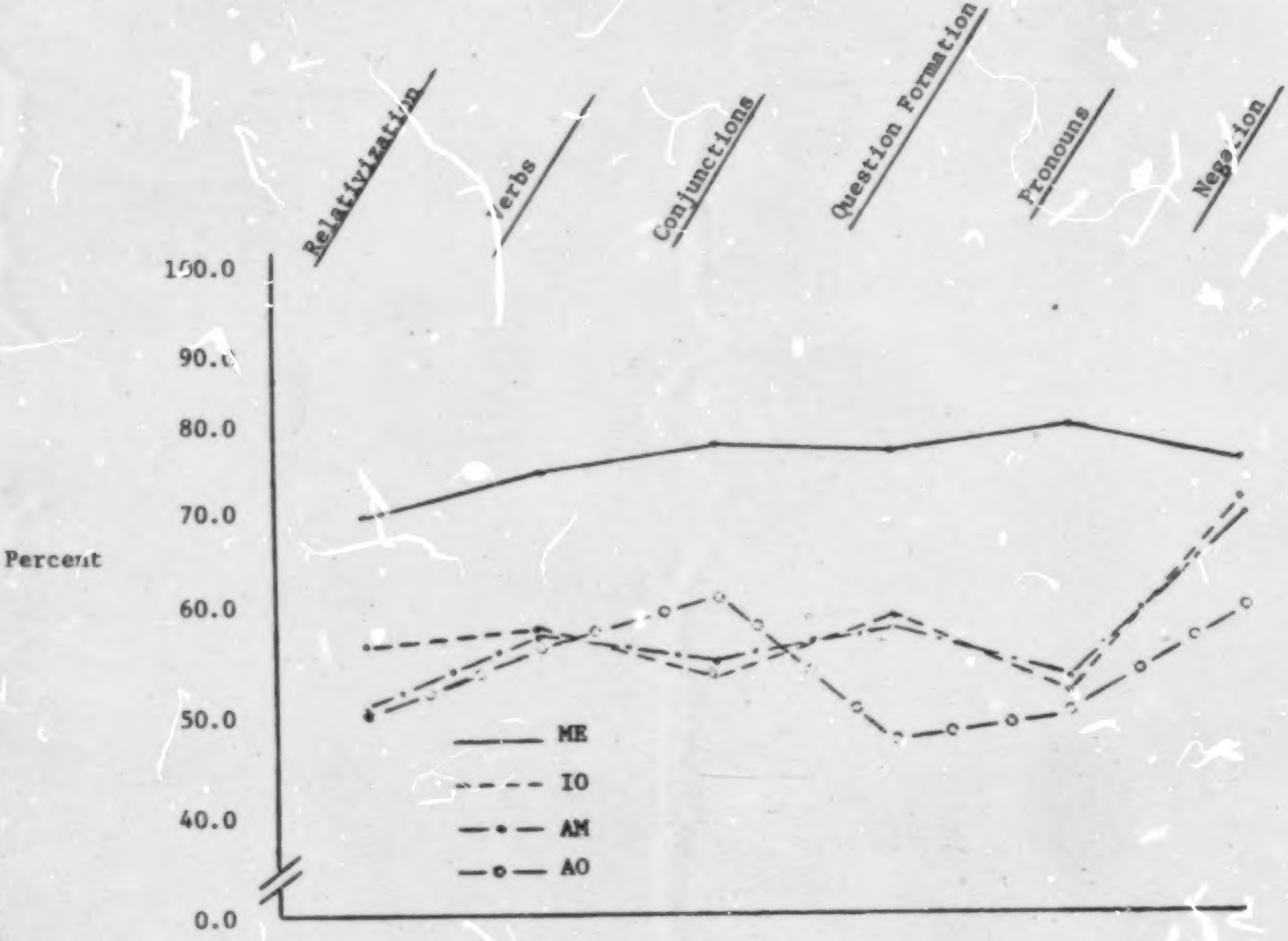

Figure 1: Means, all six Main Test Groups, by Group: 10.0 - 12.11 Age Group

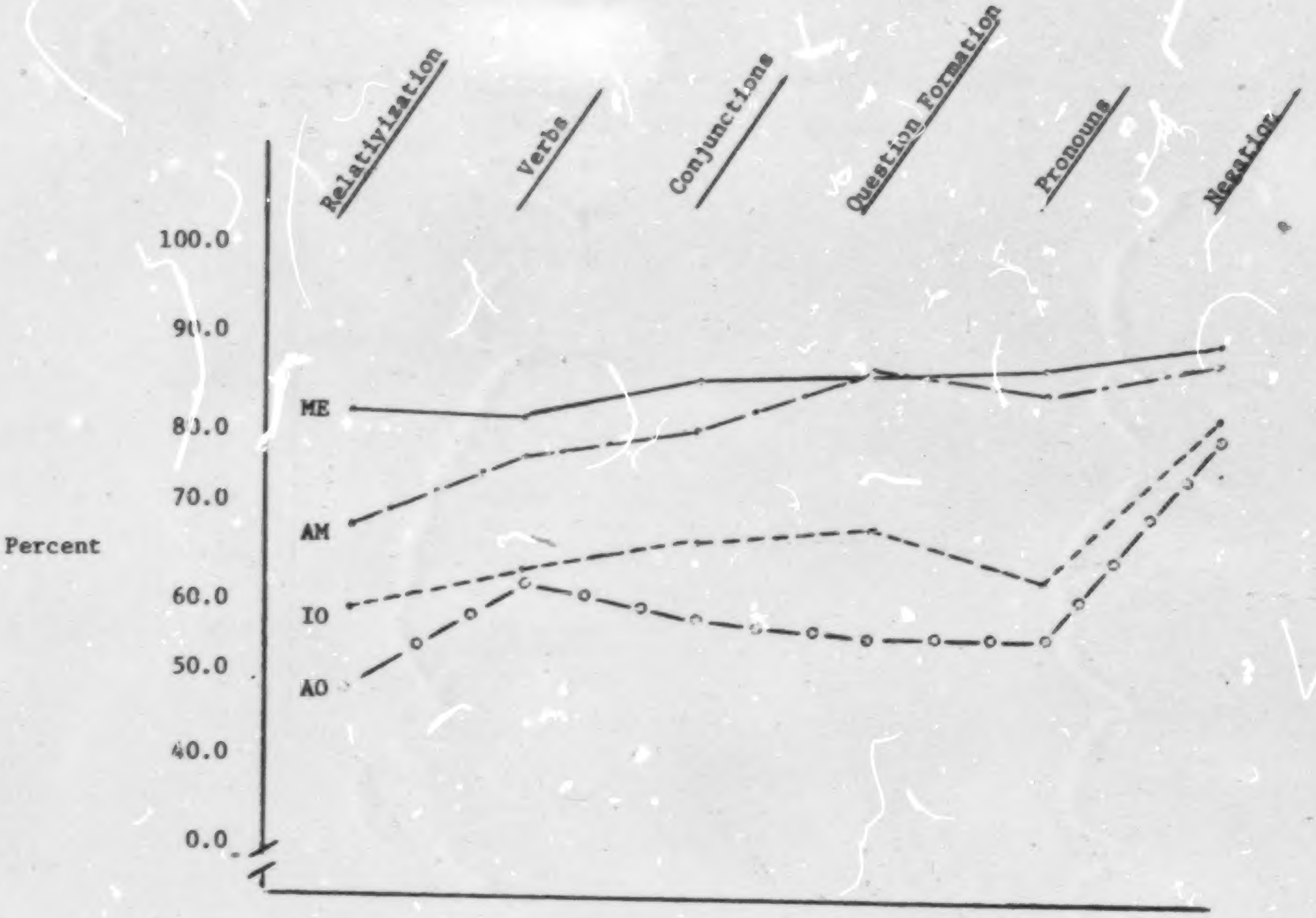

Figure 2: Means, All Six Main Tests, By Group: 13.0 - 15.11 Age Group

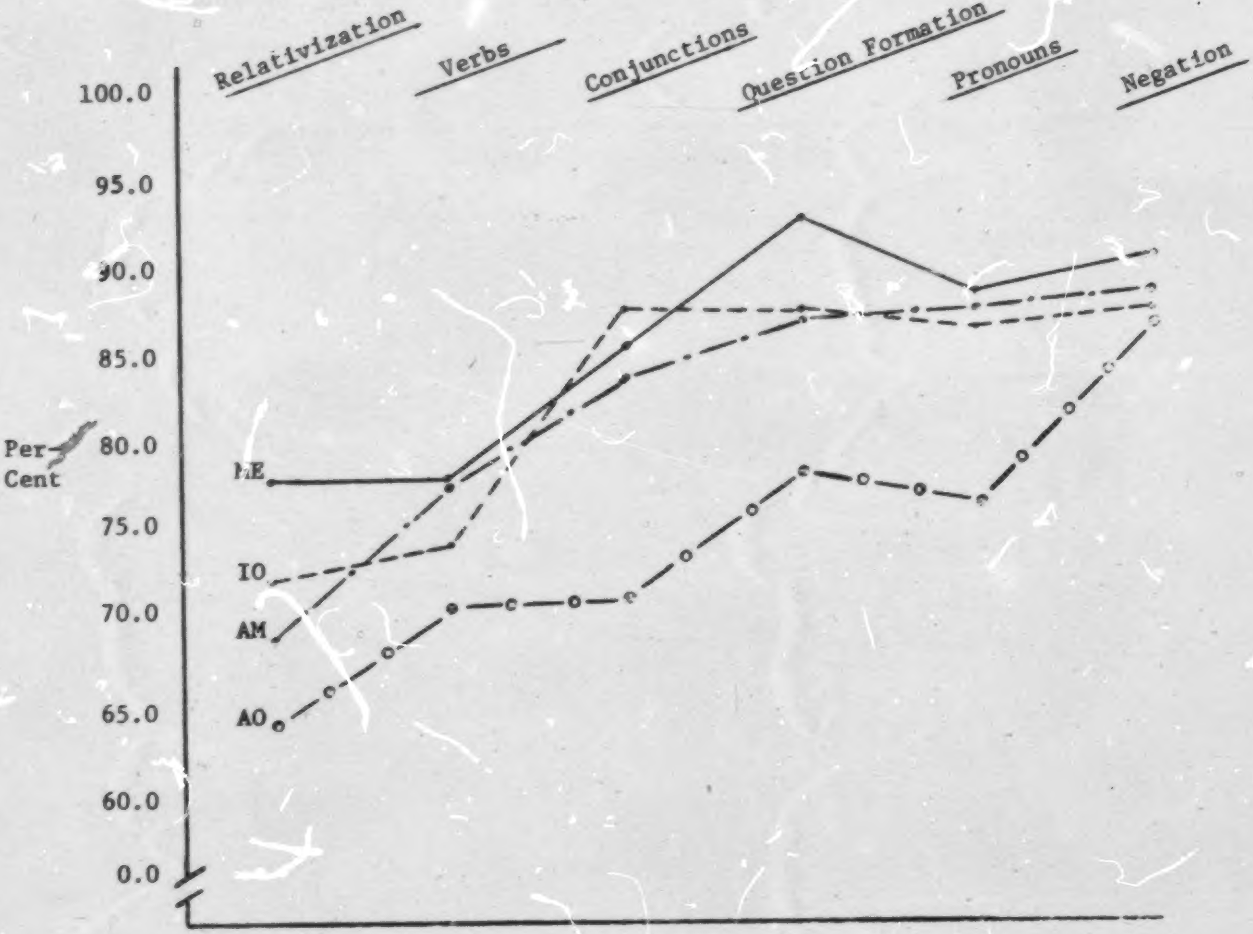

Figure 3: Means, All Six Main Test Groups, by Group: 16.0 - 18.11 Age Group

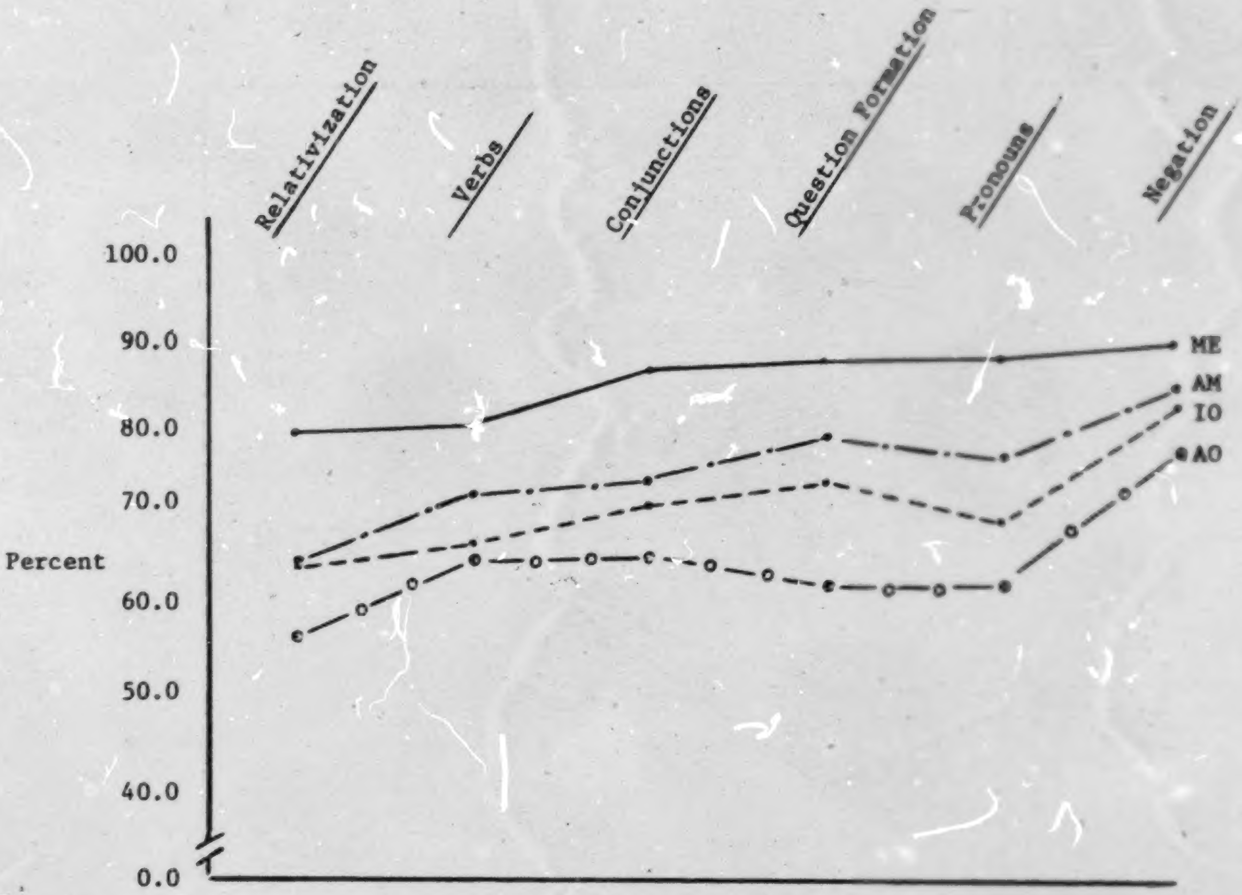

Figure 4: Means, All Six Main Structures, All Ages Combined

TABLE 39: Mean Percentage Scores, Relativization Sub-Tests, by Group (N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Copying	80.74	60.93	62.41	58.52
Embedding and relative pronoun deletion	75.96	61.11	62.84	52.78
Processing	88.89	79.32	75.15	66.20
Total, Relativization	80.87	66.35	66.31	58.06

TABLE 40: Analysis of Variance, Summary Table, Relativization

Source of Variation	df	SS	MS	F	P
Age	2	0.18478	0.09239	6.7614	0.00259
Sex	1	0.00145	0.00145	0.1060	0.74611
Group	3	0.48573	0.16191	11.8490	0.00001
Age and Sex	2	0.02691	0.01345	0.9846	0.38102
Age and Group	6	0.10907	0.01818	1.3304	0.26220
Sex and Group	3	0.02508	0.00836	0.6118	0.61064
Age, Sex and Group	6	0.03340	0.00557	0.4074	0.87050
Within Cells	48	0.65589	0.01366		

contrasts were performed (Table 41), with the ME group outperforming the other three groups on every sub-test as well as on total Relativization score. No differences were found among the AM, IO or the AO groups.

It would appear from the data that the most difficult sub-test for all four groups was the embedding and relative pronoun deletion sub-test in which the Ss were required to discriminate between correctly and incorrectly deleted (or embedded) relative pronouns. Next in order of difficulty appeared to be the Copying sub-test in which the Ss were required to recognize as incorrect a sentence containing a redundant relative pronoun. Easiest, at least for the ME group, appeared to be the Processing sub-test in which the Ss were tested on their ability to understand sentences in which relative clauses were embedded. Figure 5 shows the per cent scores in graph form by age group. It can be seen from the figure that both deaf-parent groups showed a drop-off in performance after age 16, whereas the two groups with hearing parents showed almost identical gains.

Verb Usage: Table 42 gives the mean percentages on the three sub-tests of Verb Usage. Again, there was significant differences found among the groups (Table 43), which were subsequently identified by Scheffé contrasts (Table 44) as existing between the ME group and the two Oral groups as well as between the deaf-parent groups and the hearing-parent groups. No differences were found between the ME and the AM groups, nor were there differences among the AM, IO and AO groups.

TABLE 41: Scheffé Contrasts Results, Relativization

Contrast	P	Conclusion
ME - AM	< .01	ME > AM
ME - IO	< .01	ME > IO
ME - AO	< .001	ME > AO
AM - IO	ns	AM = IO
AM - AO	ns	AM = AO
IO - AO	ns	IO = AO
(ME + AM - IO + AO)	< .001	(ME + AM) > (IO + AO)

TABLE 42: Mean Percentage Scores, Verb Usage Sub-Tests, by Group (N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Infinitives and gerunds	75.0	66.5	59.7	57.3
Verb deletion	99.7	94.1	90.6	92.7
Verbal auxiliaries	80.4	73.4	68.3	62.9
Total, Verb Usage	82.2	74.5	69.4	66.8

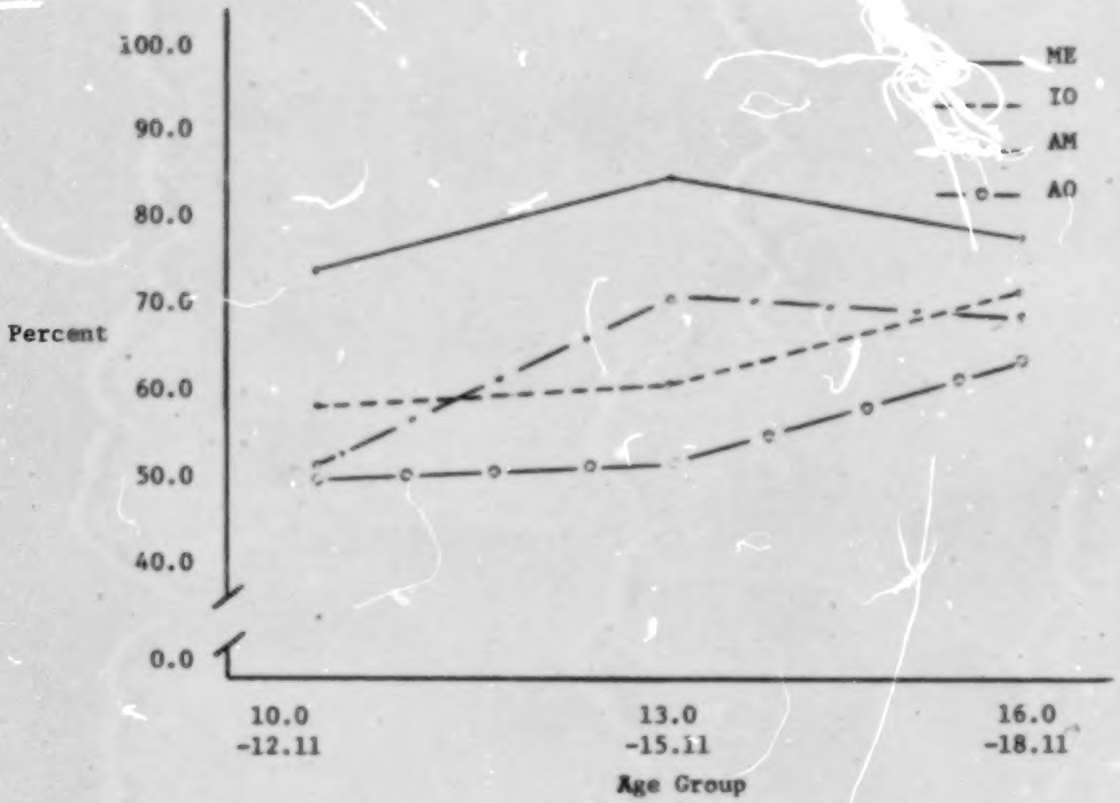

Figure 5: Percent Scores on Relativization Test, By Group and By Age Group

TABLE 43: Analysis of Variance Summary Table, Verb Usage

Source of Variation	df	SS	MS	F	P
Age	2	0.16429	0.08214	6.7694	0.0026
Sex	1	0.00190	0.00190	0.1567	0.6940
Group	3	0.24726	0.08242	6.7925	0.0007
Age and Sex	2	0.04611	0.02305	1.8999	0.1607
Age and Group	6	0.08305	0.01384	1.1406	0.3537
Sex and Group	3	0.02696	0.00899	0.7406	0.5331
Age, Sex, and Group	6	0.04660	0.00777	0.6400	0.6977
Within Cells	48	0.58247	0.01213		

TABLE 44: Scheffé Contrasts Results, Verb Usage

Contrast	P	Conclusion
ME - AM	ns	ME = AM
ME - IO	< .025	ME > IO
ME - AO	< .005	ME > AO
AM - IO	ns	AM = IO
AM - AO	ns	AM = AO
IO - AO	ns	IO = AO
(ME + AM) - (IO + AO)	< .005	(ME + AM) > (IO + AO)

None of the groups had much difficulty with the Verb Deletion sub-test, but even the high-performing ME group apparently had trouble with the Infinitives and Gerunds sub-test, as witness the comparatively low 75.0% score for the ME group on this test.

Figure 6 shows in graph form the mean per cent scores for the four groups in Verb Usage across the age groups. Again, the drop-off in the 16 - 19 year old group can be observed for the two Manual groups, while the two Oral groups show a steady gain.

Conjunctions: Table 45 gives the mean percentages of the four groups on the four sub-tests of the Conjunctions test structure. While significant differences were found between the ME and the AO group (and between the Manual and Oral groups) in total Conjunctions performance (Tables 46 and 47), the primary differences were found to exist between the ME group and the IO group on the Disjunction and Alternation sub-test (the emergence of "but" and "or" in productions), with the level of significance being found to be $p < .04$ between the ME and the IO group, and $p < .002$ between the ME and the AO group. Sequencing (correct sequencing of verb tenses in conjoined sentences) was another area in which the Ss of the AM, IO and AO groups experienced difficulty, but the differences between those three groups and the ME group did not reach significance ($p < .09$).

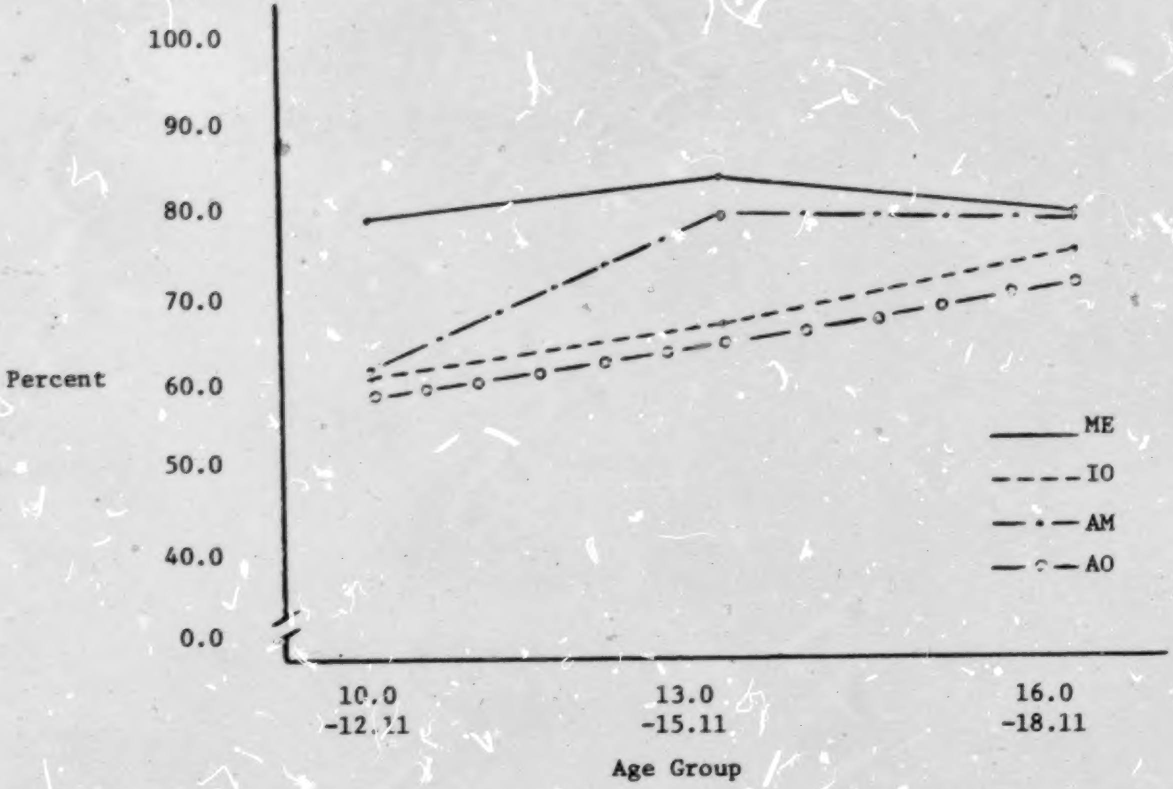

Figure 6: Percent Scores on Verb Usage, By Group and By Age Group

TABLE 45: Mean Percentage Scores, Conjunction Sub-Tests, by Group (N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Conjunctions	88.0	87.96	86.3	70.1
Conjunction deletion	94.5	87.5	85.4	84.0
Disjunction and alternation	82.7	62.2	45.5	47.6
Sequencing	85.6	67.4	70.1	67.6
Total, Conjunctions	87.5	76.5	73.1	67.6

TABLE 46: Analysis of Variance Summary Table, Conjunction

Source of Variation	df	SS	MS	F	P
Age	2	0.39735	0.19868	7.5255	0.0014
Sex	1	0.08925	0.08925	3.3808	0.0722
Group	3	0.37956	0.12652	4.7923	0.0053
Age and Sex	2	0.02451	0.01225	0.4641	0.6315
Age and Group	6	0.25604	0.04267	1.6164	0.1631
Sex and Group	3	0.01965	0.00655	0.2482	0.8622
Age, Sex and Group	6	0.16598	0.02766	1.0478	0.4068
Within Cells	48	1.26721	0.02640		

TABLE 47: Scheffé Contrasts Results, Conjunction

Contrast	P	Conclusion
ME - AM	ns	ME = AM
ME - IO	$< .07$	ME ≥ IO
ME - AO	$< .01$	ME > AO
AM - IO	ns	AM = IO
AM - AO	ns	AM = AO
IO - AO	ns	IO = AO
(ME + AM) - (IO + AO)	$< .03$	(ME + AM) > (IO + AO)

Figure 7 shows the per cent scores on Conjunctions by age group for each of the four study groups. Of interest is the marked improvement across the age groups made by the IO group; in fact, the 16 - 19 year old IO group slightly outperformed the generally superior ME group in total Conjunctions. Again, as on the previously discussed test structures, a noticeable flattening of the growth curves may be seen for the two groups with deaf parents.

Question Formation: Significant differences were found among the groups on Question Formation (Tables 48, 49 and 50). The differences were found to be between the ME group and the two Oral groups; between the AM and the AO groups; and between the deaf-parent groups and the hearing-parent groups, all differences being in favor of the ME and/or the AM group. No difference was found between the two deaf-parent groups, nor between the AM and the IO groups; however, a difference was found between the IO and the AO group which did not quite reach statistical significance ($p < .10$).

Among the sub-tests of the Question Formation structure, Answer Environments (which checked the Ss' ability to pick the correct answer to a question) was the easiest for all groups except the AO group, which found the test the most difficult of the three. Wh-Questions (Who?, When?, Which?, Where?, etc.) was the most difficult for the ME and IO groups, while the AM group found auxiliary verbs and modals the most troublesome.

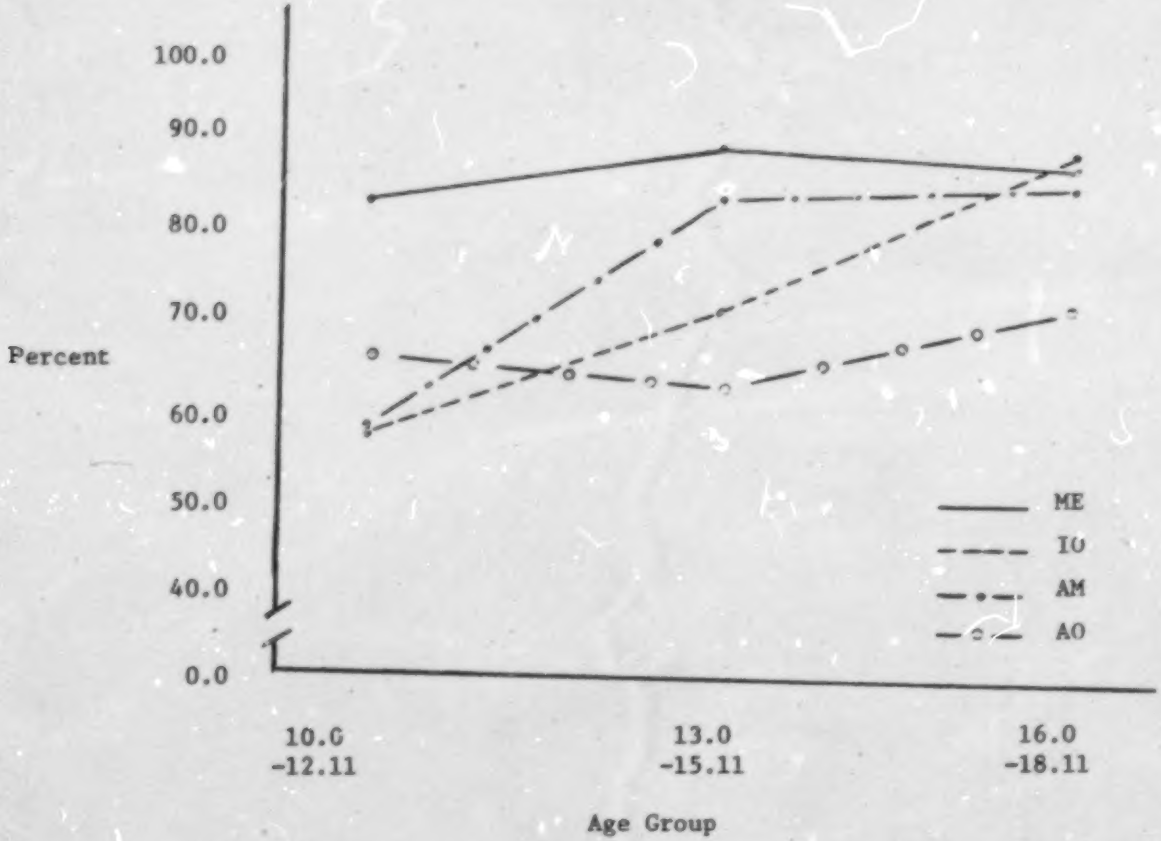

Figure 7: Percent Scores on Conjunctions, By Age Group

TABLE 48: Mean Percentage Scores, Question Formation Sub-Tests, by Group (N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Answer environments	92.8	85.5	80.06	61.1
Auxiliaries and modals	88.8	75.3	75.3	71.6
WH-Questions	84.8	76.8	68.9	65.5
Total Question Formation	89.8	81.3	76.0	64.0

TABLE 49: Analysis of Variance Summary Table, Question Formation

Source of Variation	df	SS	MS	F	P
Age	2	0.70202	0.35101	18.0020	0.00000
Sex	1	0.05957	0.05957	3.0551	0.08688
Group	3	0.62919	0.20973	10.7562	0.00002
Age and Sex	2	0.03236	0.01618	0.8297	0.44282
Age and Group	6	0.16358	0.02726	1.3982	0.23480
Sex and Group	3	0.03415	0.01138	0.5837	0.62858
Age, Sex and Group	6	0.05286	0.00881	0.4518	0.84011
Within Cells	48	0.93592	0.01950		

TABLE 50: Scheffé Contrasts Results, Question Formation

Contrast	P	Conclusion
ME - AM	ns	ME = AM
ME - IO	< .05	ME > IO
ME - AO	< .0001	ME > AO
AM - IO	ns	AM = IO
AM - AO	< .01	AM > AO
IO - AO	< .10	IO ≧ AO
(ME + AM) - (IO + AO)	< .001	(ME + AM) > (IO + AO)

Figure 8 shows the growth curves of the percentage scores on Question Formation by age group. While the usual drop-off in performance can be seen in the curve of the AM group, the ME group maintained steady improvement across the age groups.

Pronominalization: Table 51 gives the mean percentage scores on the Pronominalization sub-tests, while Tables 52 and 53 give the results of the BALANOVA and Scheffé contrasts. As can be seen, significant differences were found among the groups ($p < .0002$) which were subsequently identified as existing between the ME group and the two Oral groups; and between the deaf-parent groups and the hearing-parent groups, again with all differences being in favor of the deaf-parent groups

Relative Pronoun Referents gave all groups the most trouble, followed by Possessive Pronouns and Reflexivization. The ME and AM groups generally performed quite well on the other four sub-tests of this category, while the IO and AO groups continued to experience some difficulty with possessive adjectives and determiners.

Figure 9 shows the growth curves across the age groups, and again shows the flattening of the curve for the two deaf-parent groups.

Negation: Table 54 shows the mean percentage scores on the two Negation sub-tests, and Tables 55 and 56 give the results of the BALANOVA and Scheffé contrasts. This was the only test on which significant differences between the sexes was found ($p < .0185$), with the youngest

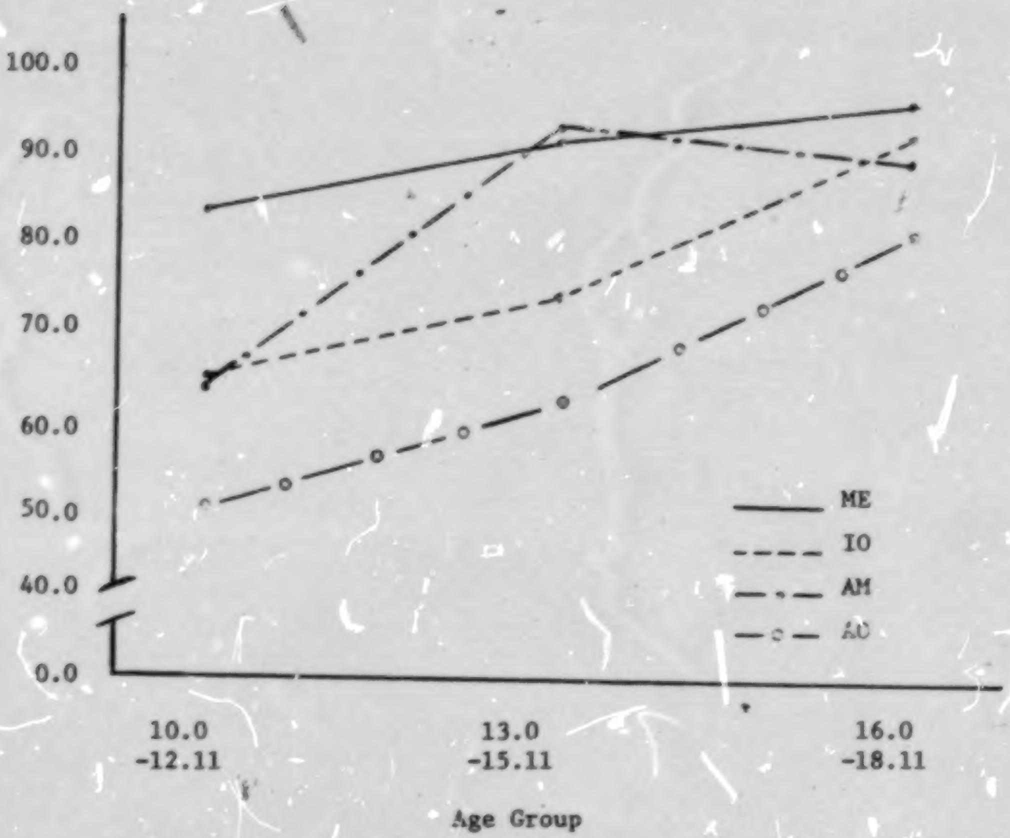

Figure 8: Percent Scores on Question Formation, by Age Group

TABLE 51: Mean Percentage Scores,
Pronominalization Sub-Tests
(N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Determiners	91.84	81.08	77.78	73.09
Backwards pronominalization	98.89	91.67	82.22	74.44
Personal pronouns	95.24	89.48	79.76	76.19
Possessive adjectives	95.83	83.73	75.79	55.87
Possessive pronouns	85.11	73.15	62.04	54.17
Relative pronoun referents	77.16	60.49	55.86	44.44
Reflexivization	86.57	73.46	64.35	58.33
Total, Pronominalization	89.93	78.67	71.15	64.39

TABLE 52: Analysis of Variance Summary Table, Pronominalization

Source of Variation	df	SS	MS	F	P
Age	2	0.75730	0.37865	14.2860	0.00001
Sex	1	0.06600	0.06600	2.4903	0.1211
Group	3	0.63870	0.21290	8.0324	0.0002
Age and Sex	2	0.02321	0.01160	0.4378	0.6480
Age and Group	6	0.26362	0.04394	1.6576	0.1521
Sex and Group	3	0.03106	0.01035	0.3906	0.7603
Age, Sex and Group	6	0.03396	0.00566	0.2135	0.9708
Within Cells	48	1.27224	0.02650		

TABLE 53: Scheffé Contrasts Results, Pronominalization

Contrast	P	Conclusion
ME - AM	ns	ME = AM
ME - IO	<.01	ME > IO
ME - AO	< .0001	ME > AO
AM - IO	ns	AM = IO
AM - AO	< .10	AM ≧ AO
IO - AO	ns	IO = AO
(ME+AM) - (IO-AO)	< .002	(ME+AM)>(IO + AO)

TABLE 54: Mean Percentage Scores, Negation Sub-Tests, by Group (N = 72)

Structure	Manual English	Average Manual	Intensive Oral	Average Oral
Negative Be-Have	87.8	86.8	82.7	83.6
Modals	93.8	86.6	85.9	77.6
Total, Negation	91.9	86.7	84.9	79.5

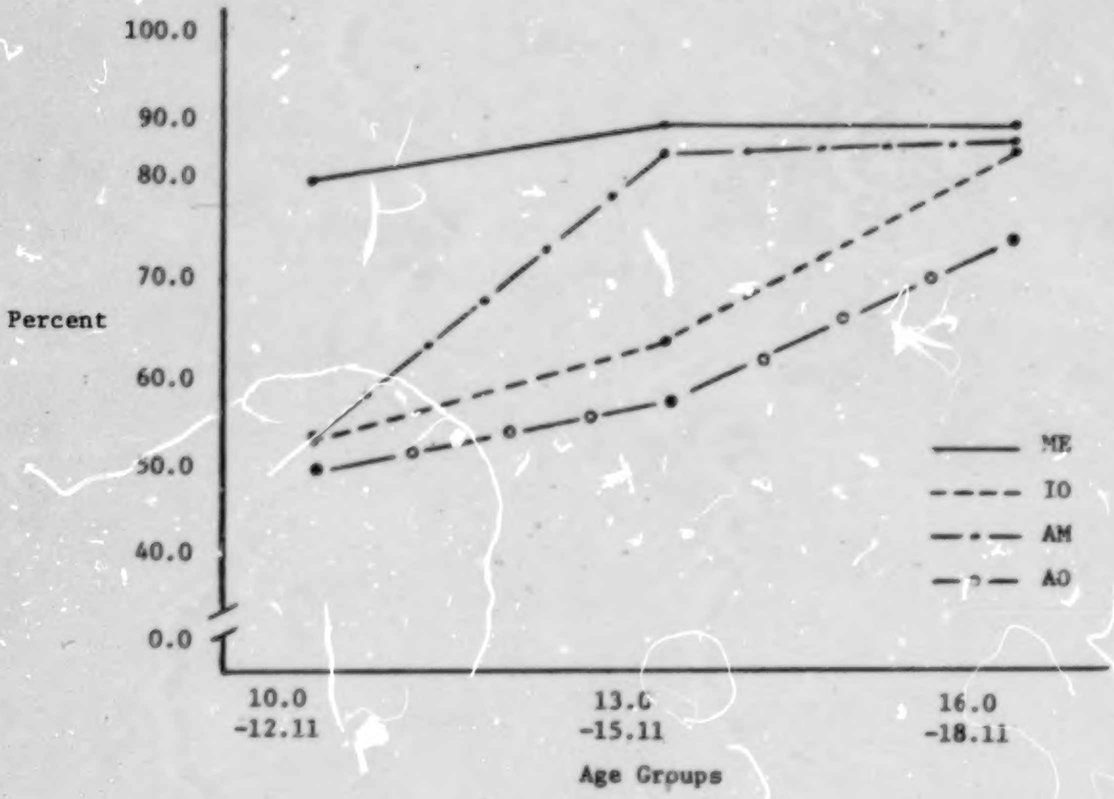

Figure 9: Percent Scores on Pronominalization, By Age Group

TABLE 55: Analysis of Variance Summary Table, Negation

Source of Variation	df	SS	MS	F	P
Age	2	0.29330	0.14664	14.7023	0.00001
Sex	1	0.05969	0.05969	5.9837	0.01815
Group	3	0.14405	0.04802	4.8137	0.0052
Age and Sex	2	0.02964	0.01482	1.4859	0.2365
Age and Group	6	0.08134	0.01356	1.3591	0.2503
Sex and Group	3	0.01441	0.00480	0.4815	0.6967
Age, Sex and Group	6	0.05624	0.00937	0.9398	0.4756
Within Cells	48	0.47878	0.00997		

TABLE 56: Scheffé Contrasts Results, Negation

Contrast	P	Conclusion
ME - AM	ns	ME = AM
ME - IO	$< .10$	ME $\geq$ IO
ME - AO	$< .005$	ME $>$ AO
AM - IO	ns	AM = IO
AM - AO	ns	AM = AO
IO - AO	ns	IO = AO
(ME+AM) - (IO+AO)	$< .03$	(ME+AM) $>$ (IO+AO)

group of females outperforming the males (see Table 36). Significant differences were also found between the groups ($p < .005$) which were subsequently identified as existing between the ME and the AO group, and between the deaf-parent and hearing-parent groups.

Generally speaking, neither of the two Negation sub-tests gave any of the groups much trouble. In fact, the Negation tests proved to be the easiest of all.

Figure 10 shows the percentage curves across the age groups for the Negation test structures. Of interest is the flattening of the growth curves for all four groups -- in contrast with the previous five test categories which showed a steady rate of growth for the two hearing-parent groups and a flattening (or a drop-off) for the deaf parent groups. This may be because all groups were approaching 100%, and a ceiling effect began to be noticeable.

Analysis of Written Language Samples

Tables 57 through 64 show the means, ANOVA summary tables, and, where significant differences were found among the groups, the Scheffé contrast results on the analyses of the written language samples. As can be seen, the ME group out-performed all other groups in everything except Mean Composition Length (on which the IO group took the lead). However, the differences among the groups were significant only on Type-Token Ratio (TTR) ($p < .05$), Number of Errors per Composition (NEC) ($p < .0001$), and on Grammatical Correctness Ratio (GCR)

[redacted]

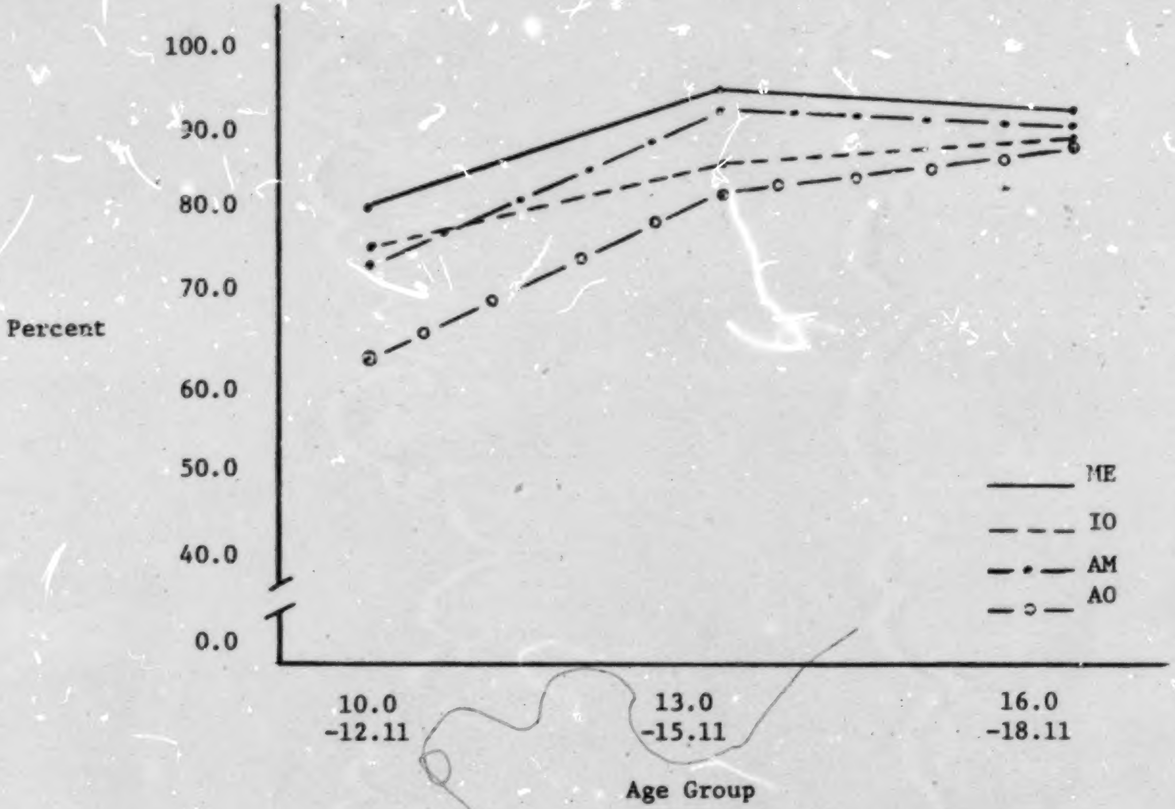

Figure 10: Percent Scores on Negation, By Age Group

TABLE 57: Mean Scores, Written Language Samples: Mean Composition Length, Type Token Ratio, Grammatical Correctness Ratio, Number of Different Words Used, and Errors Per Composition

Analysis	Manual English	Average Manual	Intensive Oral	Average Oral
Mean Composition length	142.7	139.2	148.0	102.8
Range %	78-289	60-328	56-426	48-246
Standard Deviation				
Type Token Ratio %[a]	70.6	68.5	66.2	60.5
Range %	50.0-84.0	52.0-78.0	40.0-70.0	20.0-80.0
Standard Deviation				
Grammatical Correctness Ratio[a]	90.8	88.1	87.4	76.3
Range %	88.0-100.0	50.0-98.0	64.0-100.0	50.0-100.0
Standard Deviation				
No. of different words used[a]	35.3	34.3	33.1	30.2
Range %	28-42	26-39	20-39	16-40
Standard Deviation				
No. of errors per composition[a]	2.7	5.9	6.7	11.2
Range %	0-7	1-25	0-18	0-24
Standard Deviation				
Percentile score, using variable equation for Age 14	.79	.68	.63	.34

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[a] Based on first 50 words

TABLE 58: Analysis of Variance Summary Table, Composition Length

Source of Variation	df	SS	MS	F	P
Among groups	3	22,867.778	7,622.593	1.4723	0.25
Within groups	68	316,047.222	4,647.753		
Total	71	338,915.000			

TABLE 59: Analysis of Variance Summary Table, Type Token Ratio

Source of Variation	df	SS	MS	F	P
Among groups	3	1,056.3868	352.1289	2.8663	0.05
Within groups	68	8,353.7817	122.8497		
Total	71	9,410.1685			

TABLE 60: Tukey Contrasts, Type Token Ratio

Contrast	t	P	Conclusion
ME - AM	0.77	ns	ME = AM
ME - IO	1.70	ns	ME = IO
ME - AO	3.916	<.05	ME > AO
AM - IO	0.94	ns	AM = IO
AM - AO	3.15	ns	AM = AO
IO - AO	2.21	ns	IO = AO
(ME+AM) - (IO-AO)	2.44	ns	(ME+AM) = (IO+AO)

TABLE 61: Analysis of Variance Summary Table, Grammatical Correctness Ratio

Source of Variation	df	SS	MS	F	P
Among groups	3	3187.28	1062.43	8.652	<.001
Within groups	68	8350.0	122.79		
Total	71	11,537.28			

TABLE 62: Tukey Contrasts, Grammatical Correctness Ratio

Contrast	t	P	Conclusion
ME - AM	2.592	ns	ME = AM
ME - IO	2.854	ns	ME = IO
ME - AO	7.111	<.001	ME > AO
AM - IO	-0.257	ns	AM = IO
AM - AO	4.513	< .025	AM > AO
IO - AO	4.257	< .025	IO > AO
(ME+AM) - (IO+AO)	3.683	< .06	(ME+AM) ≥ (IO + AO)

TABLE 63: Analysis of Variance Summary Table, Number of Errors Per Composition

Source of Variation	df	SS	MS	F	P
Among groups	3	741.042	247.014	8.186	< .0001
Within groups	68	2051.945	30.175		
Total	71	2792.987			

TABLE 64: Tukey Contrasts, Number of Errors per Composition

Contrast	t	P	Conclusion
ME - AM	2.447	ns	ME = AM
ME - IO	2.965	ns	ME = IO
ME - AO	6.911	< .0001	ME > AO
AM - IO	0.509	ns	AM = IO
AM - AO	4.455	< .025	AM > AO
IO - AO	3.945	< .05	IO > AO
(ME + AM) - (IO + AO)	3.741	< .05	(ME + AM) > (IO + AO)

($p < .001$). On TTR, the source of the difference was found to be between the ME group and the AO group. The differences on NEC and GCR were found to be between the AO group and the other three groups, with the AO group performing significantly worse than the other three.

Compared with the TSA, analysis of written language samples apparently did not discriminate too well between the groups.

Comparison with Original Hypotheses

The results, when compared with the original hypotheses, show that the data supported in a large measure the underlying theory that parental language model and method of communication interact to influence language development in deaf children. With respect to the individual hypotheses presented in Chapter I, the following was found:

Hypothesis I: With respect to syntactic language ability as measured by the TSA: (A) the ME group will be found superior to the other three groups; (B) the AM group will be found equal to or superior to the IO group, and superior to the AO group; and (C) the IO group will be found superior to the AO group.

Hypothesis I (A) was partly supported by the data which showed that, while the ME group consistently performed better than the other three groups, the differences were significant only between the ME group and the two Oral groups. Except for one test (Relativization), in which the ME group did significantly better than the AM group, no other significant differences were found between the ME and AM groups.

Hypothesis I (B) was not supported by the data which showed that the AM group, while consistently outperforming the IO and AO groups, was not significantly different from either group except on Question Formation with the AM significantly superior to the AO group.

Hypothesis I (C) was not supported by the data. The IO group, while it outscored the AO group, was not found to be significantly different from the AO group.

Hypothesis II: With respect to language achievement as measured by the Language, Paragraph Meaning, Word Meaning, and Spelling sub-tests of the SAT, the following will be found: (A) the ME group will be found superior to the other three groups; (B) the AM group will be found equal to or superior to the IO group, and superior to the AO group; and (C) the IO group will be found superior to the AO group.

Hypothesis II (A) was fully supported by the data which showed that the ME group was significantly superior to the other three groups on all sub-tests of the SAT when equal-n ANOVAs and Tukey contrasts were used; and partly supported even when unequal-n ANOVAs and Scheffé contrasts were employed.

Hypothesis II (B) was not supported by the data, which showed that, except for one sub-test (Word Meaning), in which the AM group was significantly better than the AO group, there were no significant differences found among the AM, IO and AO groups on any of the sub-tests despite the AM group's consistently better performance.

Hypothesis II (C) was not supported by the data. The IO and AO groups were not significantly different on any of the SAT sub-tests.

Hypothesis III: With respect to written language as measured by TTR, GCR, MCL, Number of Different Words Used, Number of Errors Per Composition, and Spelling, the following will be found: (A) the ME group will be found superior to the other three groups; (B) the AM group will be found superior to the IO and AO groups; and (C) the IO group will be found superior to the AO group.

Hypothesis III (A), (B) and (C) were not supported by the data which showed significant differences only between the ME and the AO group on TTR, and between the AO group and the other three groups on NEG and GCR (with the AO group being significantly inferior to the other three groups). Otherwise, no significant differences were found in the analyses of language samples.

Hypothesis IV: With respect to all test measures, the Manual groups (ME and AM) will be found superior to the Oral Groups (IO and AO).

Hypothesis IV was fully supported by the data on the TSA and SAT test results. However, where the analyses of written language samples was concerned, it was recognized that the extremely poor showing of the AO group (percentile score using variable equation for age 14 for that group was .34) would skew the data negatively for the Oral groups, so no attempt was made to compare the deaf-parent groups with the hearing parent groups on written language samples. Otherwise, the deaf-parent groups were significantly superior to the hearing parent groups on every test measure given.

Summary of the Results

Table 65 gives a summary of the results of the SAT and the TSA, with direction of the means and significant contrasts given. As can be seen, significant differences were found among the groups even after the effects of SES, PIQ and CA were removed. In most cases, the differences found were in favor of the ME group over one or both of the two Oral groups. Although the ME group consistently out-performed the AM group as well as the two Oral groups, the differences reached statistical significance between the two Manual groups on only three of the four SAT language sub-tests, and on only the Relativization sub-test of the TSA. No differences were found between the AM group and the IO group although the AM group outscored the IO group on every test except two (SAT Language and Paragraph Meaning sub-tests). Nor were any significant differences found between the IO and AO group although the IO group consistently scored a little higher than the AO group.

In every test, the deaf-parent groups did significantly better than the hearing-parent groups ($p < .03$ or smaller).

Performance on the TSA improved significantly across the age groups and, except for the Negation sub-test of the TSA, no significant differences were found between the sexes on test performance although the females generally scored a little higher than the males.

TABLE 65: Summary of Findings, Stanford Achievement Test and Test of Syntactic Ability

SAT	ANOVA, unequal n's (Direction of Means)	p	Significant Contra
SAT Language	ME > IO > AM > AO	.0001	ME > IO > AM > AO
SAT Para. Mean	ME > IO > AM > AO	.0001	ME > AM > AO
SAT Word Mean	ME > AM > IO > AO	.01	ME > AO
SAT Spellin	ME > AM > IO > AO	.10	None

SAT	ANOVA, equal n's	p	Significant Contra
SAT Language	ME > IO > AM > AO	.0001	ME > IO > AM > AO
SAT Para. Mean	ME > IO > AM > AO	.0001	ME > IO > AM > AO
SAT Word Mean	ME > AM > IO > AO	.0001	ME > IO > AM > AO
SAT Spelling	ME > AM > IO > AO	.005	ME > IO > AM > AO

TABLE 65: Summary of Findings, Stanford Achievement Test and Test of Syntactic Ability

OVA, unequal n's (Direction of Means)	p	Significant Contrasts (Scheffé)
ME > IO > AM > AO	.0001	ME > IO > AM > AO
ME > IO > AM > AO	.0001	ME > AM > AO
ME > AM > IO > AO	.01	ME > AO
ME > AM > IO > AO	.10	None

OVA, equal n's	p	Significant Contrasts (Tukey)
ME > IO > AM > AO	.0001	ME > IO > AM > AO
ME > IO > AM > AO	.0001	ME > IO > AM > AO
ME > AM > IO > AO	.0001	ME > IO > AM > AO
ME > AM > IO > AO	.005	ME > IO > AM > AO

TABLE 65 (continued)

TSA With effects of SES, PIQ and AGE removed (MANOVA)

With effects of SES removed:	$p < .0051$
With effects of SES and PIQ removed:	$p < .0209$
With effects of SES, PIQ and AGE removed:	$p < .0020$

TSA Test performance

Improves sign. w/age

No sex diff. (exc. on Negation) but females generally out-perform males

Deaf parent groups significantly better than hearing parent groups ($p < .03$ or smaller)

	(Direction of Means)	M vs O p	Among groups p	Significant (Scheffé)
REL (1)	ME > AM > IO > AO	.003	.00001	ME > AM, I
QUEST (4)	ME > AM > IO > AO	.001	.00002	ME > IO, A
NEG (6)	ME > AM > IO > AO	.03	.0052	ME > AO
CONJ (3)	ME > AM > IO > AO	.01	.0053	ME > IO (p
VERB (2)	ME > AM > IO > AO	.03	.0007	ME > IO, AO
PRON (5)	ME > AM > IO > AO	.005	.0002	ME > IO, AO

TABLE 65 (continued)

SES, PIQ and AGE removed (MANOVA)

removed: $p < .0051$

and PIQ removed: $p < .0209$

PIQ and AGE removed: $p < .0020$

n Negation) but females generally out-perform males

ignificantly better than hearing parent groups ($p < .03$ or smaller)

tion of Means)	M vs O p	Among groups p	Significant Contrasts (Scheffé)
M > IO > AO	.003	.00001	ME > AM, IO, AO
M > IO > AO	.001	.00002	ME > IO, AO; AM > AO
M > IO > AO	.03	.0052	ME > AO
M > IO > AO	.01	.0053	ME ≥ IO ($p < .07$); ME > AO
M > IO > AO	.03	.0007	ME > IO, AO
M > IO > AO	.005	.0002	ME > IO, AO

CHAPTER V

SUMMARY AND DISCUSSION

Summary

Four groups of deaf *S*s between the ages of 10.0 and 18.11 years were tested, employing the Test of Syntactic Ability (Quigley and Power, 1971); the language sub-tests of the Stanford Achievement Test (SAT); and analyses of written language samples in a study of the influence of early language and communication environment on the later syntactic language ability of deaf children. The groups, 18 *S*s in each, were dichotomized by whether the parents were hearing or deaf; and further sub-grouped by the language ability of the parents if the parents were deaf, and by the amount and intensity of Oral pre-school training (and implementation at home) provided by the parents if the parents were hearing. In each of the four groups, three male and three female *S*s were tested from each of three age categories: CA 10.00 - 12.11; CA 13.00 - 15.11; and CA 16.00 - 18.11. The average age of each of the four groups was 14.8 years. The composition of each group is summarized below.

Manual English (ME) Group: *S*s in the ME group had a mean Performance IQ (PIQ) of 121; were discovered to be deaf at a mean age of approximately six months; were first enrolled in a formal educational program for deaf children at a mean age of approximately four and a half years; had deaf parents who had a good command of English and who used manual communication (MC) in the form of Manual English (ME) with the *S*s from infancy. Thirteen of the *S*s in the ME group had deaf siblings. Average income of the *S*s' families was $15,972. Socioeconomic Status (SES) factor was 1.1366.

Average Manual (AM) Group: *S*s in the AM group had a mean PIQ of 114; were discovered to be deaf at a mean age of four and one half months; were first enrolled in a formal educational program for deaf children at just over four years of age; had deaf parents whose written language showed gross deviations from Standard English, and who used MC with the *S*s from infancy. Fourteen of the *S*s in the AM group had deaf siblings. Average income of the *S*s' families was $9,306. SES factor was -2.631.

Intensive Oral (IO) Group: IO group *S*s had a mean PIQ of 119; were first discovered to be deaf at a mean age of 1.19 years; were first enrolled in a formal *Oral* educational program for deaf children at a mean age of just under two years; had parents who received formal training in using oral methods with their children and used these exclusively and intensively in the home to supplement school training. *S*s had been continuously enrolled in educational programs since initial enrollment. Only oral methods of communication were still being used in the home for the majority of the *S*s (13 out of 18), and in no case had any form of MC been introduced in the remainder before the *S*s had reached nine years of age. One *S* in this group had a deaf sibling. Mean income for the *S*s' families was $17,569. SES factor was 2.6311.

Average Oral (AO) Group: Ss in the AO group had a mean PIQ of 107; were first discovered to be deaf at a mean age of 1.23 years; were first enrolled in a formal Oral educational program for deaf children at a mean age of just over four years of age; had parents who received no formal training in oral methodology, and did not attempt any special training of their children before enrolling them in school. Only oral methods of communication were still being used in the home with the majority of the Ss (12 out of 18), and in no case had any form of MC been introduced in the remainder before the Ss had attained eight years of age. None of the Ss in this group had deaf siblings. Average income for the Ss' families was $10,000. SES factor was -1.6121.

The results showed significant superiority of the ME group over the two Oral groups on five of the six major test structures of the TSA. The ME group was found to be superior to the AM group on the Relativization sub-test of the TSA (although outscoring the AM group on every test measure), but not significantly different on the other five. No differences were found between the AM, and the IO groups on the TSA, but the AM group was significantly better than the AO group on the Question Formation sub-test. No differences were found between the IO and the AO group on any of the TSA sub-tests although the IO group generally did better than the AO group, and the AM group did better than the two oral groups.

On the SAT, the ME was found significantly superior to the other three groups on all four sub-tests, with the ME group being from one to nearly four grades ahead with its nearest competitor being the AM group.

Again, no differences were found among the AM, IO and AO groups except on one test (Word Meaning) where the AM group was found to be significantly better than the AO group.

The results of the analyses of written language samples were more variable. Generally speaking, the ME group outperformed the other three groups, but the differences were significant only between the ME and the AO group -- or between the AO group and the other three groups, with the AO group being found to be significantly inferior to the other three groups.

The results also showed that the two Manual groups were significantly superior to the two Oral groups on every test measure employed.

Discussion

Every effort was made in the present study to select as Ss four distinctly different groups. The ME group was composed of Ss whose parents were language-competent deaf persons who used MC with the Ss from the time the Ss were discovered to be deaf. In 13 of the families, there were also deaf siblings who, presumably, also used MC. This would mean that most or all of the daily conversations the Ss were exposed to were carried on in MC, with the assumption being made that the language competence of the parents would be reflected in the grammatical structure of the form of MC used — Manual English. It is assumed that the first attempts of the Ss to participate in the family conversations would have been simple, one sign communications, followed by the putting of two and three signs together until a rudimentary form of ASL began to emerge. As the child gained in ability to use ASL, it is reasonable to assume that the parents began the natural parental role of "accepting" the child's ASL communications, but reflecting back in simple ME. Thus corrected, the child would modify his own MC until, in time, ME would begin to emerge in the child's communications also.

On the other hand, the AM group was composed of S̲s whose parents' written language was grossly deviant from Standard English. The parents, therefore, would be unable to fully correct their child's communications via the reflection and/or expansion process, so the child would continue to use ASL. However, since the parents, and in 14 of the families the siblings, were MC-users, the child would at least be able to communicate both receptively and expressively, and to observe a great deal of communication going on around him whether directly involved or not.

The IO group was composed of S̲s whose parents reported they expended every effort toward obtaining the finest and most intensive training they could find for their children; all mothers and some of the fathers as well sought and received training in oral methodology and used this training to implement and augument school training in the home -- sometimes to the extent where the home became, in effect, an extension of the school, and the parents surrogate teachers. From the reports, it would appear that the parents of the IO S̲s lost no opportunity to bombard the S̲s with language through oral and written means, labeling the furniture, taking pictures and pasting them in scrapbooks with labels underneath, cutting out different colored objects and requiring *S*s to match them with the spoken description, etc. Fixing up a special learning area in a corner of one of the rooms in the family home was a frequent tactic employed by parents who worked daily with their children. At the same time, however, when questioned about the efficacy of their methods from the standpoint of how well their children could communicate expressively and receptively (through speech and speechreading only) with mother, father, siblings, relatives and strangers by the time the child reached kindergarten age, the answers revealed an underlying despair in most cases. The *S*s could understand and be understood by *only the mother* in the majority of the cases. Th means that the language input was limited to what the mother could communicate, and the *S* probably received little benefit from the daily conversations going on around him which did not directly involve him.

The parents of the *S*s in the AO group more or less left to the schools the educating and training of their children in language. Oddly enough, the parents of this group reported that the siblings were better able to communicate with the deaf child than were the parents or anyone else. It is possible that the siblings used gestures or pantomine to get their messages across to the deaf child, ignoring parental taboos or indicating a more informal and free atmosphere when the parents were not around. At any rate, language input was most likely severely restricted until the child entered a formal training program.

All Ss except one were selected on the basis of school reports that they were free of any other educationally significant handicaps. The one exception, a male S in the youngest ME age group, was reported to have emotional problems. However, since no substitute was available of the same age and sex, his scores were used. A slight depression of the means was noted because of this S. Otherwise, the children were normal deaf children without additional psychological, educational or physical handicaps insofar as could be determined.

The ME and IO groups had the highest PIQ of the four groups. Only two points separated the two groups — a difference that did not even approach significance. Nor did the difference between those two groups and the AM group approach significance. It was only when the ME group was compared with the AO group that significance ($p < .05$) was found. However, the MANOVAs eliminated the effects of PIQ, and showed significant differences among the groups. While differences in PIQ might partly explain the large differences in performance between the ME and the AO Ss, it does not explain why the AM group, which was five points lower in PIQ than the IO group, consistently out-scored the IO group even though the differences in the means were not significant. Nor does it explain why the IO group, just two points behind the ME group in mean PIQ, was not found significantly different in performance from the AO group.

The IO group parents reported significantly higher SES than did the other three groups. Normally, high SES has a beneficial influence on academic performance of children, and this may well explain why the IO group parents were able to seek out and obtain early and intensive training for their children as opposed to the lack of same in the AO group. The majority of the ME Ss came from families where both parents worked (12 out of 18), whereas only half of the IO and AO mothers (9 out of 18 each), and five of the AM mothers were employed. At the same time, the average family income for the ME group was nearly $1,600 less than that reported by the IO group despite almost identical amounts of education being reported by the parents of the two groups and a larger number of working mothers in the ME group. The parents of the ME group also reported occupations lower on the socioeconomic scale than those reported by the IO group, and the ME fathers' occupations were also lower on the scale than those of the AO group fathers. This would seem to support other surveys of the occupational status of deaf workers which showed that deaf people tend to be underemployed when compared with hearing persons of similar ability and education (Crammatte, 1968, and others).

An interesting phenomenon was observed in the age at which deafness was confirmed and the age at which the Ss were first enrolled in a formal training program. While differences between the two Oral groups on age at enrollment were controlled in the study, no such controls were exerted on the two Manual groups and it was found that, although the Manual group parents determined their children's deafness at six months of age or earlier, they did not enroll their children in formal educational programs until the children were more than four years of age. The early confirmation of deafness by the Manual group parents was probably the result of the deaf parents' expecting to find that their children were deaf also, whereas the hearing parents would not have had any reason to suspect their children would be deaf. At any rate, both Oral group parents had confirmed their children's deafness by the time the children were a bit over a year old. And in the case of the IO group the parents then moved quickly to obtain training for themselves and their children, for most IO children were enrolled in formal infant or preschool training programs by the time the children were two years of age.

Another interesting finding emerged from a study of the questionnaire responses to the item asking about home training. Most of the ME or the AM group respondents did not bother to answer the question, or if they did answer it, it was the type of response that made it clear the respondent thought the question superfluous; "We didn't have to train him in any special way. We just raised him like we did our other kids." or "No need. We are deaf too." A few of the ME parents wrote brief comments such as "Well, about all we really did was teach him how to sign, using baby-talk ASL at first, but as he got older, correcting his grammar and teaching him to use good English in his signing."

The IO group parents, as was discussed earlier, covered pages and pages of the questionnaire with detailed accounts of what was done to implement school training at home. The AO group parents limited themselves to a sentence or two, usually in the vein of "We just talked to him a lot like they told us to do," or did not answer the question at all.

When asked how the parents communicated among themselves when the deaf Ss were not around, all of the Oral group parents responded "verbally". The answers from the Manual group parents were mostly the expected, "in sign language." One respondent answered the question simply by writing "We are deaf too!", thus giving rise to the suspicion that the respondent considered the question a silly one to ask a deaf parent of a deaf child.

In analyzing the results of the study, it is clear that the TSA offers a more discriminating measure of language ability than analysis of written language samples does. The Relativization sub-test, in particular, which gave the Ss in the study the most trouble, was able to discriminate between the ME and the AM group as well as between the ME and the two Oral groups. While the SAT was also able to discriminate between the ME and the AM group, it offers less specificity than the TSA in identifying particular areas of language learning that deaf students experience difficulty in mastering.

As can be seen in Figures 6 through 10, the two Oral groups showed parallel and steady gains across the three age groups on all six major TSA test structures, on five of the six structures tested, the two Manual groups showed a flattening of the growth curves after age 13.0 - 15.11, and differed from each other in that the AM group showed significantly large gains in percentage from the youngest age group to the middle age group, but a leveling off from the middle age group to the oldest group.

The ME group showed virtually no gains across the age dimension on three of the structures tested (Conjunctions, Verb Usage, and Pronominalization); a slight but steady gain on Question Formation; and, on Negation and Relativization, an increase from the youngest age group to the middle age group but a decrease from the middle age group to the oldest group.

This "plateau effect" may be attributable to the ME group's approaching 100%, and, as can be seen from Table 66, more of the ME group did indeed score 100% than did the other three groups on some of the tests; or it may be that the finding is an artifact of the TSA scoring procedures. It is possible that some of the ME Ss and other language competent Ss were penalized for rewriting some of the incorrect structures in a more sophisticated form than that required by the test items -- by inserting punctuation. Although the Ss had been instructed that their knowledge of punctuation was not being tested, and that they should ignore punctuation in correcting any incorrect sentences, it was noted on occasion that ME Ss rewrote the incorrect "No the baby is crying" as "No, the baby is crying" instead of the required "The baby is not crying" (from the Negation sub-test). The sentence as corrected by those Ss is perfectly grammatical if given as a response to the question, "Is the baby sleeping?", but the response required by the scoring procedures was that of changing the sentence to a negative form. The Ss, therefore, were charged with a wrong answer despite the rewrite. Another example of this type of error was seen on the Question Formation sub-test item "Who does the baby love its mother?" This particular item did not require a rewrite, just a decision on whether it was right or wrong. Again, some

TABLE 66: Number of Ss Achieving 100 Per Cent:
By Sub-Test, Total Structure and By Group

	ME	AM	IO	AO
Relativization				
Rel. Copying	1	0	0	0
Rel. Processing	6	2	1	0
Total Structure	0	0	0	0
Verbs				
Verb Deletion	17	12	11	9
Verb Aux.	0	0	1	0
Total Structure	0	0	0	0
Negation				
Be, Have	2	0	0	0
Modals	4	2	0	0
Total Structure	1	0	0	0
Conjunctions				
Deletions	12	12	6	5
Conjunctions	9	6	10	1
Disjunct. and Altern.	10	5	5	1
Sequencing	0	1	2	0
Total Structure	0	0	1	0
Question Formation				
Answer Environ.	5	3	2	1
Aux. and Modals	4	1	3	0
WH Questions	4	0	1	0
Total Structure	0	0	0	0
Pronominalization				
Deletion	5	0	2	1
Bkwds. Pronominalization	16	11	6	5
Personal Pronoun	7	6	4	2
Possessive Adjective	15	10	4	3
Possessive Pronouns	11	8	6	3
Rel. Pron. Deletion	1	0	0	0
Reflexivization	2	2	1	1
Total Structure	0	0	0	0
Total No. Receiving 100% on Sub-tests by Group	131	81	65	32
% of possible	33%	20%	16%	8%

ME Ss judged it correct but pencilled in a comma on the example sentence, thus changing it to "Who does the baby love, its mother?" Such answers were judged wrong even though the sentence as corrected by the Ss displayed a more sophisticated command of English than was required to give a simple right or wrong answer.

It was also indicated that many of the Ss, Manual as well as Oral, responded to the content of the test items rather than the grammatical structure. An example of this was the number of "Wrong" answers to the test item (from Question Formation), "Can babies walk?". The item provided space for a rewrite, and the Ss who judged the sentence to be wrong almost always changed it to "Babies can't walk!"

Another alternative explanation for the plateau effect might be that it reflected the usual drop off in performance noted in other studies (Gentile, 1969; Babbini and Quigley, 1970) between the ages of 13 and 18 or 19. This would not explain, however, why the two Oral groups continued to progress while the Manual group "plateaued" or fell below their previous means. However, many ME-type Ss are in college by the time they are 18 years of age, so it might be that the oldest group of ME Ss tested in the study (none of whom were college students) were either slightly less capable than their peers who were already in college — or in the "Senior Slump" often noted among seniors in schools for deaf students, who are more interested in preparing for college (or work) than in school work or tests.

One other explanation may be that the Ss in the Manual groups were not properly programmed by their schools. It will be recognized that schools for deaf children base their curricula on the needs of the average deaf child -- the one who enters school with inadequate language skills. Most of the teacher attention and planning centers around these children while the children of deaf parents in the same classes may more or less mark time in terms of langauge growth. To be sure, many schools have "academic tracks" for the brighter children, but not all of the schools have separate curricula for them. As a result, when the brighter students reach high school age, differences in performance are less marked between the academic and vocational or technical students.

Regardless of differences between the growth curves across the age categories, the study found that there were significant differences between the Manual and the Oral groups on every test measure employed. This is most likely due to the early communication made possible by use of MC, particularly where the form of MC used is ME. It must also be remembered that the ME group parents did not use any of the more refined, morphemic types of sign language such as Seeing Essential English, Signing Exact English, or Linguistically Oriented Visual English. They used signs and fingerspelling in correct grammatical order. Therefore, the current attempts at developing an ultra-refined, sophisticated form of 100% grammatical sign language may not be necessary or even desirable. It may be that a morphemic sign language such as S.E.E. or L.O.V.E. would be unnecessarily complicating the task of teaching language, and that appropriately used standard signs and fingerspelling with modifications to more closely approximate English syntax will do the job just as well, if introduced early enough in the child's life.

Conclusions

One major conclusion to be drawn from the present study is that language input made possible by early employment of MC permits parental language competence to influence the child's developing language ability. Since the high visibility of MC provides the child with both a receptive and expressive means of communication, he is enabled to test his developing language ability by using it with his parents, siblings, and other MC-using persons in his environment, and to modify it according to the feedback he receives. If the manual language input is in grammatically correct ME, he has a greater opportunity to generate grammatical rules consistent with Standard English than if the language input is in ASL, where the child's tendency to develop grammatical rules different from those of Standard English is heightened. By the same token, when communication is limited and labored, such as in the case of only oral input where the child's speech and speechreading skills are slow to develop, then language input is limited to the isolated words he is able to learn to recognize on the lips, and language output is restricted to the isolated words the child has learned to pronounce intelligibly. Generation of syntactic rules of grammar, therefore, would be dependent upon the quantitative and qualitative rate at which the child's speech and speechreading skills develop. At any rate, few children develop speechreading skills rapidly enough to be able to follow the rapid verbal communication taking place among the adults and any hearing siblings in the child's environment; thus, the child is deprived of important language input during the first few years of his life.

A second conclusion to be drawn from the study is that the superiority of the deaf-parent groups over the hearing-parent groups shown in previous studies (cited earlier) was possibly attributable to the inclusion of some ME-type Ss in the deaf-parent groups and the inclusion of some AO-type Ss in the hearing-parent groups. The present study found that, while the two combined Manual groups were significantly superior on every test measure employed, when the ME and AO group scores were deleted, no significant difference was found between the AM and the IO group (although the AM group consistently outscored the IO group). Having deaf parents, therefore, does not automatically guarantee the deaf child an academic or syntactic advantage over one who has hearing parents insofar as the measures used were able to discriminate. The greatest advantage appears to come when the parents are competent in Standard English and use Manual English with and around the child, as witness the marked superiority of the ME group over both Oral groups on nearly every test measure employed and that some advantage is found where early Manual communication exists regardless of degree of deviation from Standard English syntax.

CHAPTER VI

IMPLICATIONS AND RECOMMENDATIONS

It would seem reasonable to expect that hearing parents of a deaf child could use ME just as effectively with their child as can language-competent deaf parents, but many problems stand in the way of hearing parents considering the adoption of any form of MC. First and foremost is the long-standing methods controversy. Parents who are attempting to reach some kind of a rational decision with respect to the method of communication they should use with their child are immediately caught up in the battle between the "experts". On one hand, they are told that any form of MC will be (1) detrimental to their child's language; (2) so "easy" for their child that his motivation to learn to speak and read lips will be reduced, therefore turning him into a misfit who will not be able to integrate into the hearing world; and (3) an advertisement of his handicap to anyone who sees him using his hands to communicate with in public. On the other hand, they are shown statistics which show that some deaf children of MC-using deaf parents achieve at a higher level than some deaf children of hearing parents -- statistics which offer some hope until they are immediately challenged by other "experts" as biased or empirically unjustified conclusions based on faulty research designs, sketchy evidence, or improper selection of sample groups.

Such decisions as are finally made by the parents, or are made for them by the administrators of the educational program in which their child is eventually enrolled, are seldom reversible until long past the time when a change in methodology could do the child the most good. If the decision is the wrong one for their child, he eventually becomes another cipher in the grim statistics of language deficient and educationally retarded deaf children.

The findings of the present study indicate that use of MC does not retard language development when the grammatically correct ME is used. The superiority of the ME group's performance over that of the two Oral groups bears ample witness to this. In fact, use of ME in early childhood appears to give the deaf student a distinct advantage over deaf students whose parents do not use any form of MC -- even when the parents expend large amounts of time, effort, and money in obtaining early, intensive and continuous oral training for their children and work intensively with them at home during the pre-school years.

It would be foolish to denigrate the importance of speech and speechreading ability for deaf children; their value in society is obvious. Rather, it is pointed out that use of ME does not preclude training in speech and speechreading. In fact, logic would lend itself to the assumption that having a language base should ease the task of the deaf child to learn to recognize words he already knows when he sees them spoken, and that he would soon learn that if he wants to communicate with non-signing people in his environment he will have to learn to attempt to improve his speech.

The implications of the present study are that parents of deaf children can and should learn ME as soon as their children are discovered to be deaf, and should train themselves to use it among themselves as well as with the child any time the child is around. This is not by any means a startling, new revelation. Bonet (Bender, 1960) advocated in 1620 that "everyone living in a house with a deaf-mute should be forced to learn the manual alphabet."

It is therefore recommended that parent-infant preschool training programs incorporate instruction in both ASL and ME in their training programs. ASL is included, for the child's initial attempts to express himself will most likely be more or less in ASL, and the parent will have to be able to understand the child's communication before he can begin modifying it. At the same time, the parents should use ME among themselves, for the exposure to grammatically correct language as used by adults is important langauge input that should not be omitted from the child's early environment.

It is also recommended that the TSA be further tested, refined, and possibly shortened for use as a diagnostic tool in schools for deaf children. It offers much potential for identifying areas of weakness in language curricula as well as in identifying individual student needs for remedial work in language.

In particular, the TSA needs revision of the scoring procedures. The items were designed and keyed on the basis of intended responses which were, in turn, based on the analysis of written language samples collected earlier. An analysis of the obtained responses, both from the present study Ss and from the Quigley study should help to eliminate the problems caused by unanticipated responses which were not taken into consideration during the construction of the test, and some of the cultural variants which confuse the Ss may need revision.

An analysis of the responses obtained should give considerable information on the type of test items that confused or misled the Ss, and provide a body of additional responses that can be judged correct for each of the test items.

Further research is recommended to clarify the role of ASL or Ameslan with respect to those children whose early language exposure and input has been ASL or Ameslan. It must be remembered that deaf children may not be "native" ASL-users, and the language development and acquisition reflects the form of communication they were exposed to during the early childhood years. It appears that initial ASL communications require special intervention in order to gradually modify the syntax to more closely approximate Standard English. Special language curricula designed specifically to capitalize on this basic language foundation may facilitate transfer to correct English syntax. Some of the techniques employed in teaching English as a second language could be of use in developing a curriculum for deaf children of ASL-using deaf parents.

Finally, it is recommended that specific curricula and/or intervention strategies be developed and employed with ME-type deaf students which will maximize their potential for development of normal language.

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